

TEN CENTURIES
OF
EUROPEAN PROGRESS

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"AID TO SURVEY PRACTICE," "AID TO ENGINEERING SOLUTION," "HYDRAULIC WORKS,"
"CANAL AND CULVERT TABLES."

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P R E F A C E.

FOR most purposes of reference and study a single volume of moderate bulk is preferable to the use of many volumes with large maps of atlas dimensions. A condensed panoramic view of the general development of Europe, the chief object of this work, needs an accompanying brief account of its political condition, to clear obscurity and difficulty, also a few small maps. If the task of representing the whole in a small book has been ambitious, as well as very laborious, many details can be well spared in arriving at a terse generalisation that is more valuable than the less significant numerous details thus omitted. Chronological order has been strictly necessary to show the ways and modes of progress: though an alphabetical index is attached for use, most persons are at least well aware in which century various political events and scientific and useful developments took place; and in each distinctive section of his book belonging to each century the number of pages is small. The tables at the beginning form a guide to local reference through nationality.

All books have their presumed defects, either as old, new or curious; or as too large, too small, or too neither; but most well written books are useful, when suitably used by a sympathetic reader. This book also will require that the mind of those using it enter into the grooves laid down, which are as simple as practicable: hence the reader is requested to glance

Preface

at the preface, summaries, tables, and index, so as to learn the framework of the book, before reading or diving into it.

One of the special features of this compilation is that the information used has been in most cases obtained from foreign books direct, and from translations of them. The Oriental portions, and names of Moslem scientists, ignored most needlessly till now, have been taken from Oriental sources. The only regret in such matters is that a knowledge of Slavonic languages was wanting, and that this ignorance prevented reference to works written in all those languages.

As to the language of the book itself, it is necessarily terse English, and unfortunately the horrible literary jargon of the period has been adopted. The author would have much preferred to write in pure English free from Latin derivations throughout; for foreign words are needful only as technical terms, and apart from these, simple English could have been used everywhere. But the inert opposition of the masses, and the old habits of scholasticism, in books, lectures, sermons and newspapers, are not easily overcome; and the danger of presenting any check to the use of the book had to be considered.

If there exists any other work of the same scope giving the same information collectively in any language, the author has not heard of it after much research. The gist of the book, apart from the necessary attachments, is the account of the development of scientific and useful progress in Europe, from the time that the Moslems were scientists and Christian Europe was ignorant. The hindrances caused by political and other difficulties, the introduction of legal, and philosophical studies, and various literary and superstitious crazes, may be traced in this development. The various modes of encouraging and retarding science and progress in different nations may be

Preface

deduced ; and some forecast of the future may be gained under corresponding conditions. It is hence quite possible that these pages may not only convey knowledge to the simple reader, but notions to political men of action.

The information given for the present or Nineteenth Century is on a very reduced scale compared with that for all the others ; in fact it is merely a condensed appendix to it, given by way of illustration. The reasons for this are, that many books combine to supply such information for this century, that the complete information for it will not be available till about 1910, and that to continue on the foregoing scale would involve adding another volume to the work. Besides, the doings of this century are historically and rationally less important than those of the preceding nine, for they less indicate causation, and effect of condition.

In apologising for inevitable defects and errors, it may be mentioned that labor, research and care have not been wanting, and hence probably they are few.

L. J.

WESTMINSTER,
14 June, 1890.

GENERAL SUMMARY.

Frontispiece—Map of Europe, with its frontiers.

Preface; General Summary; Order of Sections; List of Maps.

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General Remarks on Progress.—Financial Condition.—Archaic Find.

1. Astronomy.—Navigation.—Geodesy and Topography.
2. Zoology.—Botany.—Agronomy.—Gardening.—Forestry.
3. Chemistry.—Mineralogy.—Metallurgy, and Geology.
4. Mathematics: Instruments and Appliances.
5. Physics: Steam, Electricity and Magnetism, Animal Magnetism.—
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6. Anatomy, Pathology, Physiology.
7. Languages: Latin, Greek, Arabic, Sanskrit.—Education.
8. Fortification, Tactics, Naval Tactics, Strategy, Construction and
Building.
9. Mechanism and Machines.
10. Fine Art: Music, Pictorial Art, Sculpture, Poetry, and the Drama.

II.—Political Condition.

General Remarks.

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2. Religious War and Priestly Opposition.
3. Civil War and Riot.
4. Sickness and Famine.
5. Colonial and Maritime Influence.

III.—General Record of Progress and Events.

Arranged in chronologic order, but indexed at the end of the book.

IV.—Discovery in Special Branches.

1. Archaic.—2. Naturalistic.—3. Chemistry and Mineralogy.—4. Steam
and Applications.—5. Electricity and Magnetism, and Applications.—
6. Explosives and Ignition.

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TABLES
OF
GENERAL CONDITION OF EUROPEAN COUNTRIES.

I., II., III., IV.

Table I

TABULAR RETROSPECT OF

Century.	Years.	In Asia Politically	In Europe. Politically.	In England. Politically.
Tenth	— 900 to 999	Abbasid decline.	MAGYAR INVASION.	<i>English Union.</i>
Eleventh	—1000 to 1099	Saljuki supremacy.	DANISH CONQUEST.	<i>Danish conquest.</i>
Twelfth	—1100 to 1199	Early crusades.	EARLY CRUSADES.	<i>Angevin kings.</i>
Thirteenth	—1200 to 1299	Mughal conquest.	MUGHAL CONQUEST.	<i>Baronial revolt.</i>
Fourteenth	—1300 to 1399	Moorish decline.	ANGLO-FRENCH WAR.	<i>Anglo-French war.</i>
Fifteenth	—1400 to 1499	Persian Sahai period.	OTTOMAN CONQUEST.	<i>Yorkist Civil War.</i>
Sixteenth	—1500 to 1599	Indian Sahai period.	SPANISH SUPREMACY.	<i>Tudor period.</i>
Seventeenth	—1600 to 1699	Manchu conquest.	FRENCH GRANDEUR.	<i>Stuart period.</i>
Eighteenth	—1700 to 1799	European intercourse.	ENGLISH COLONISATION.	<i>Hanoverian period.</i>
Nineteenth	—1800 to 1885	Indian development.	GERMAN RESTORATION.	<i>Parliamentary age.</i>

Table I

THE TEN CENTURIES

In England. Externally.	In England. Claves and Sects.	In England. Development.	Years.	Century.
Danish immigration. Norwegian settlement.	<i>Benedictine monks.</i> <i>Roving Danes.</i>	Wool growing. Linen making. Herbalism.	900 to 999—	Tenth.
Danish immigration. Norman immigration.	<i>Norman reeves and abbots.</i> <i>Saxian clergy—Jews.</i>	Windmills. Inland navigation.	1000 to 1099—	Eleventh.
Irish settlement. Annexations in Frankland.	<i>Knightly orders.</i> <i>Medical knights.</i>	Herring fishery. Broadcloth making.	1100 to 1199—	Twelfth.
Immigration of Lombards and Flemings.	<i>Mendicants and inquisitors — Attorneys.</i>	Baconian science Copper and lead mining.	1200 to 1299—	Thirteenth.
French garrisons. Hanseatic monopoly.	<i>Peers by patent.</i> <i>Wycliffites — Itinerants.</i>	Explosives. Ironworks.	1300 to 1399—	Fourteenth.
Loss of Guienne and of Scotland.	<i>Routiers.</i> <i>Medical men.</i>	Anatomy. Literature.	1400 to 1499—	Fifteenth.
North American colonisation.	<i>National clergy.</i> <i>Commercial companies.</i>	Gardening. Distant commerce.	1500 to 1599—	Sixteenth.
Scottish reunion. Indian trade opened.	<i>Puritanical sects.</i> <i>Mine adventurers.</i>	Mathematics. Astronomy. Mineralogy.	1600 to 1699—	Seventeenth.
Loss of some American colonies.	<i>Scientific societies.</i> <i>Canal engineers.</i>	Chemistry. Ironworks.	1700 to 1799—	Eighteenth.
Australian and African colonisation.	<i>Trade-unions.</i> <i>Limited liability companies.</i>	Applications of steam and electricity.	1800 to 1885—	Nineteenth.

Table I—continued.

TABULAR RETROSPECT OF THE TEN CENTURIES

Century.	Years.	In Italy. Externally.	In Italy. Internally.	In Italy. Development.
Tenth	— 900 to 999	Magyar invasions. German Union, 962. Moslem attacks.	<i>Papal feuds.</i> <i>Illyria and Dal-</i> <i>mata annexed,</i> <i>998.</i>	Hospitals of refuge.
Eleventh	—1000 to 1099	Rise of Papal power, 1075.	<i>Rise of Genoa,</i> <i>1008.</i> <i>Schismatics</i> <i>burnt.</i>	Pharmacy, c. 1070.
Twelfth	—1100 to 1199	Arnoldists, 1160. Lombardian league, 1176.	<i>Crusading fleets</i> <i>Levantine com-</i> <i>merce.</i> <i>Fall of Milanese</i> <i>church in 1190.</i>	Shipbuilding. Architecture. Funding, 1171.
Thirteenth	—1200 to 1299	Annexation of Apulia and Sicily, till 1250 Angevin invasion, 1266.	<i>Genoese war,</i> <i>1205-29.</i> <i>Papal revolt,</i> <i>1236-47.</i> <i>Pisa is ruined,</i> <i>1290.</i>	Silk fabrics, 1209. Byzantine art, 1240. Bridges. Algebra and Optics.
Fourteenth	—1300 to 1399	Hungarian war. German recovery, 1310-38. Rienzi's revolt, 1347.	<i>Apostolian war,</i> <i>1304.</i> <i>Condoitieri,</i> 1336. <i>Genoese war,</i> <i>1350-81.</i> <i>Anti-Papal</i> <i>league, 1375.</i>	Physic gardens, 1309. Earliest anatomy, 1316. Greek literature, 1340. Artistic academies, 1345. Small banks, 1377.
Fifteenth	—1400 to 1499	Papacy restored, 1447. Ottoman war and invasion, 1453- 82.	<i>Witchcraft atro-</i> <i>cities, 1426.</i> <i>Milanese war,</i> <i>1425-42.</i> <i>Holy Office, 1478.</i>	Greek literary de- velopment. Rise of oratorio and opera, 1440 and 1480. Dyeing, 1460.
Sixteenth	—1500 to 1599	Spanish rule, 1526. Ottoman wars, 1536-71.	<i>Loss of Asiatic</i> <i>commerce.</i> <i>French wars,</i> <i>1508-28.</i> <i>Decline of Genoa,</i> <i>1570.</i>	Climax in Fine Art. Rise of the drama. Development of anat- omy. Rise of astronomy and geology, 1517.
Seventeenth	—1600 to 1699	Ottoman wars, 1645-99.	<i>Jesuit difficulties.</i> <i>Opposition to</i> <i>Spanish rule.</i>	Physics, Botany, Astro- nomy, Music. Decline.
Eighteenth	—1700 to 1799	Imperial annexa- tion, 1714. French conquest, 1797 to 1813.	<i>Jesuit difficulties.</i> <i>Loss of the</i> <i>Morea, 1715.</i> <i>Corica ceded,</i> <i>1768.</i>	Electricity, Mathe- matics, Music. Further decline.
Nineteenth	—1800 to 1899	Savoy dynasty, 1861. Italian unity.	<i>Priestly repres-</i> <i>sion</i> <i>Revolts.</i> <i>Austrian wars.</i>	Revival after 1861. Shipbuilding and com- merce. Sciences.

Table II

TABLE OF POLITICAL CONDITION
FORMER MOSLEM COUNTRIES

CENTURY.	MOSLEM SPAIN.	MOSLEM ITALY.	MOSLEM SICILY
1.	Navarrese war, 907-19. Reconquest of all Spain, 995. Navarra lost, 998.	Recovery by Abbas, 900-42 Defeat of German ^y , 982-83	New dynasty of Abbas, 900. Greek attacks, 956-68.
2nd	Castilla lost, 1026. Disruption of Arab Spain, 1031. Rise of Almorabethun ^y , 1090.	Norman conquest of Apulia, 1040-43. Norman conquest of Ca- labria, 1053-60.	Greek attacks, 1020 to 1034. Norman attacks, 1039 to 1058; conquest, 1061 to 1072. Syracuse lost, 1088.
3rd	Aragon lost, 1139. Rise of Almuwahade ^y , 1148. Great success, 1196.		
4th	Balearic Island ^y an- nexed, 1208. Fall of Almuwahade ^y , 1224. Rise of Bani Nasr, 1238.		
5th	Great Christian war, 1333-44. Civil war, 1359-62.		
6th	Permanent decline after 1411. Last great war, 1471 to 1482. Extinction in 1492.		

Table III

TABLE O

NORTHERN EUROPE

CENTURY.	DENMARK.	ENGLAND.	NETHERLANDS.	GERMANY.	POHLEN.
Tenth . .	Religious and Civil war.	Complete Union in 923.	Seven separate Duchies. Lorraine reconstituted, 916. Lower Lorraine separated, 959.	Formation in 922. Strong in 925. Complete in 962.	Obscure till 968.
Eleventh .	Annexation of England, 1013 to 1042.	Danish conquest in 1013. Separated, 1042.	Crusade in 1097.	Decline in 1077.	Rise of power 1000.
Twelfth . .	Conquest of Pommern, Livonia, and Mecklenberg.	English supremacy in Europe after 1154.	Large emigration eastward, 1150.	Papal opposition continued. Guelphic party, 1140.	Weakened and divided after 1139.
Thirteenth	Anarchy and priestly revolts from 1241.	Baronial revolt, 1215 to 1265.	..	Habsburgs, 1273 to 1332. Restor. 1289.	Mughal conquest (occupation), 1240 to 1293.
Fourteenth	Livonia sold, 1346. Recovery of Denmark in 1357.	French wars and annexation, 1346-58.	Revolt of Kabbeljaunen, 1359, at Delft. Flanders annexed to Burgundy, 1369.	Bohem supremacy, 1347. Restor. 1355. First Suanian league, 1370.	Independence in 1345-66. Lithuania annexed, 1386.
Fifteenth .	Reunion of Norway and Sweden, 1397.	Yorkist 07p. 1402. Disruption, 1449.	All the Netherlands become Burgundian, 1430-78; and become Austrian provinces, 1478 to 1516.	Austrian supremacy after 1438. Second Suanian league, 1488.	Decline and Ottoman invasion, 1498.
Sixteenth .	Loss of Sweden in 1525.	Recovery after 1513. Naval power.	Spanish acquisition, 1516. Revolts against Spain, 1568, 1572, 1579. Separation, 1580. Spanish Netherlands separated, 1598.		Livonia divided, 1561. Reunion of Lithuania in 1569.
Seventeenth	More losses in 1660.	Parliamentary War, 1642. Dutch wars, 1652-74.	Independence acknowledged, 1650. English war, 1652-74. French acquisition in 1659, 1678, 1686.		Swedish conquest, 1656. Ottoman war, 1671-82.
Eighteenth	Small recoveries.	French wars, 1701-14, 1742-45; 1755-63. Coalition war, 1778-83, 1793 to 1802.	Austrian Netherlands reconstituted in 1706. French occupation, 1794-1813.		Partition, 1772, 1793, 1794.
Nineteenth	Loss of Norway in 1814.	Parliamentary period after 1827. French war, 1803-15.	King restored, 1813. Kingdom reconstituted, 1815. Union of Belgium, Limburg, and Luxemburg, 1815. Belgium separated, 1831.	North German restoration, 1870.	.. ..

Table III

POLITICAL CONDITION

MIDDLE EUROPE

WEST FRANKS.	BURGUNDY.	AQUITAINE.	BOHEMIA.	HUNGARY.	CENTURY.
Anglo - Danish conquests in 907-12.	Formed in 888. Enlarged in 930.	Declared independent in 987.	A Carolingian province.	Permanent settlement, 972.	Tenth.
Obscure.	First partition in 1033. Annexed to Germany.	Gascony annexed in 1038.	A kingdom vassal to Germany, 1086.	Civil wars from 1041 to 1112.	Eleventh.
Encroachment in 1180-99	Second partition in 1125.	Union with England in 1154.	Civil wars, 1095 to 1198.	Rise of power and enlargement, 1120 to 1196.	Twelfth.
FRANCE. First rise of France in 1214.	A small Duchy.	French seizure, 1204; restored, 1259; French seizure, 1294.	Power and enlargement after 1241.	Mughal conquest and ravages, 1241 to 1296.	Thirteenth.
English annexation in 1358.	Later Duchy enlarged in 1369-84.	English second recovery, 1356.	Luxemburg dynasty, 1310 to 1438. Supr. in Germany, 1347.	Recovery in 1308-46.	Fourteenth.
Second rise of power in 1452.	Netherlands annexed, 1430. Acquired by Austria in 1477-82.	French seizure in 1443.	Hussite wars, 1419 to 1436. First Austrian Union, 1436 to 1458.	First Austrian Union, 1436 to 1462. Polish dynasty, 1490 to 1526.	Fifteenth.
Spanish war and ruin by 1596.	.. ..	.. ..	Austrian dynasty after 1526.	Ottoman conquest in 1526. Austrian recovery, 1552 to 1571.	Sixteenth.
Third Rise; French grandeur after 1659.	.. ..	.. ..	Protestant wars, 1618 to 1648. Re-union with Austria, 1648.	Re-union with Austria, 1606.	Seventeenth.
Decline after 1762 to 1793. Republic.	.. ..	.. ..	.. ..	.. ..	Eighteenth.
Napoleonic period. German war, 1870. Republic.	.. ..	.. ..	.. ..	.. ..	Nineteenth.

SOUTHERN EUROPE

CENTURY.	PORTUGAL AND ALGARVES.	SPAIN.	SARDINIA AND CORSICA.	ITALY.	NAPLES AND SICILY.
Tenth . .	.. ..	Acquisitions in 912 to 987, are lost in 998.	.. ..	Italian kingdom, 888 to 962. Union with Germany.	Byzantine province. Moslem occupation.
Eleventh .	Taken from the Moslems by Fernando I in 1040. Castilian county in 1094.	Recoveries before 1027.	Moorish conq 1000. Sardinia conquered by Pisans, 1022. Genoese attack Corsica, 1090, Pisan conquest, 1099.	Papal opposition begins in 1076.	Norman conquest, 1061 to 1088.
Twelfth .	Loss of Lisbon, 1111. Kingdom formed, 1143. Lisbon taken, 1148; and lost in 1168.	Losses to the Moors in 1102.	Pisan occupation of Sardinia, 1165. Genoese occupation of Sardinia, 1175. Corsican wars of Pisa and Genoa, 1200 to 1297.	Lombard cities freed in 1176.	German annexation, 1194.
Thirteenth	Lisbon recovered, 1203. Algarves occupied, 1223. Algarves annexed, 1267.	Temporary conquest of Moslem Spain in 1236.	Corsica assigned to Aragon in 1297.	Papal revolt, 1236 to 1247.	Angevin dynasty in Naples, 1265.
Fourteenth	Claim on Castilla, 1269. Castilian wars in 1273 and 1281. English intervention in 1282 and 1285.	Great Moorish war, 1233 to 1244.	Corsica occupied by Aragonese, 1300. Sardinia occupied by Aragonese, 1324.	German recovery, 1310-38.	Aragonese dynasty in Sicily.
Fifteenth .	Centa taken, 1415. Madeira taken, 1420. Guinea mining, 1422. African and Indian exploration, 1485-99.	Union of Christian Spain, 1479. Ottoman invasion, 1484. Entire conquest, 1492.	Second Aragonese occupation of Sardinia, 1428. The Company of S. George acquires Corsica, 1450-1553.	Entry of Maximilian, 1496.	Aragonese acquisition of all in 1442. French attack, 1434 to 1495.
Sixteenth .	Venetian and Egyptian war, 1504. Colonial settlement. Spanish annexation, 1580.	Spanish supremacy in Europe, 1519 to 1659.	Spanish recovery of Sardinia, 1517. French seize Corsica in 1553, and assign it to Genoa, 1559.	Coronation of Charles V., 1530.	Spanish recovery, 1502-3.
Seventeenth	Colonial losses independent, 1640. Spanish Treaty, 1703.	Decline begins, 1640.	.. ..	Venetian conquest of the Morea, 1699.	French intrigues and attacks.
Eighteenth	Saved from Spain by the English, 1763.	Bourbon dynasty, 1701.	English occupy Sardinia, 1708-14; cession to Savoy, 1720, in exchange for Sicily. Corsica assigned to France, 1768.	French conquest, 1797 to 1813.	Austrian occupation, 1796-35. Bourbon dynasty after 1735.
Nineteenth	Saved from France by the English, 1813. Miguelist wars, 1828-34.	French conquest, 1808 to 1813.	.. ..	Savoy dynasty, 1861.	Annexed to Italy, 1860.

Table III—continued.

POLITICAL CONDITION

SEMI-ORIENTAL EUROPE

BYZANTINE EMPIRE.	RUSSIAN DUCHIES.	KIPCHAK.	SYRIAN PRINCEDOMS.	CENTURY.
Many wars and losses.	Dynasty of Rurik from 847 Attack on Constantinople, 865, 904, 941. Attack on the Chazars, 960, 988. Baptism of Vladimir I., 988.	Dynasty of Bighu in 960.	.. ..	Tenth.
Recovery of Anatolia, 1099.	Division of the Duchies, 1015. Polish wars in 1027, 1037, 1067. Attack on Constantinople, 1043. Civil war of the Dukes, 1050	Unknown.	Principdoms founded, 1097-99, chiefly by Flemish Counts.	Eleventh.
Attacked by William II. of Sicily, 1185.	Polish war, 1136 to 1138. Founding of Moscow, 1147, and of Vladimir, 1150. Division of the Duchies, 1150.	Unknown.	Annexations, 1102-23. Lost to Salahuddin, 1187-88. Recovery by the English, 1189-92.	Twelfth.
Latin Empire, 1204 to 1261.	Polish war in 1207 and 1220. Mughal conquest, 1224. The Duchies are tributary to Kipchak, 1224 to 1480.	Conquests of Eastern Europe, 1241-99.	German intervention, 1220. Moslem successes, 1236-38. English intervention, 1241. Khwarizmi conquest, 1244. Loss of all, 1260-91.	Thirteenth
First Ottoman invasion, 1321.	.. . . . RUSSIA.	Sabai irruption and occupation from 1380.	Rhodes taken, 1309. Smyrna taken, 1341.	Fourteenth.
Ottoman complete conquest, 1453.	Independence gained, 1480. Kazan taken, 1486. Great Mughal emigration, 1494. Polish war, 1500-06.	Ottoman conquest of Krim, 1475. Loss of Russian Duchies, 1480.	Smyrna lost, 1402. Defence of Rhodes, 1480.	Fifteenth.
.. ..	Mughal wars, 1520, 1524, 1541. Conquest of Kipchak, 1552-54. Part of Livonia acquired, 1562-69. Polish wars, 1580-82. Caucasia acquired, 1595.	Sarai destroyed, 1502; Kazan destroyed, 1552; Astrakhan, 1554.	Rhodes is taken by the Ottomans, 1522.	Sixteenth.
.. ..	Polish attacks, 1607-34. Caucasia lost, 1617. Smolensk lost, 1634. Polish wars, 1654-67. First Ottoman war, 1678 to 1681.	.. ..	.. ..	Seventeenth.
.. ..	Swedish war, 1658 to 1709. Baltic provinces acquired, 1722. Peter becomes Emperor, 1721. Ottoman wars, 1739, 1768, 1773, 1790. Krim acquired, 1770. Pohlen acquired, 1772-95.	.. ..	.. ..	Eighteenth.
GREECE.	Georgia acquired, 1800. Napoleonic invasion, 1812. Franco-English war, 1854-56. Circassia acquired, 1860. Ottoman wars, 1828, 1853, 1877.	.. ..	.. ..	Nineteenth.
Independence acknowledged 1830. Kingdom in 1832.				

Table IV

TABLE OF POLITICAL CONDITION
MODERN COUNTRIES

CENTURY.	SWEDEN AND FINNLAND.	BRANDENBURG AND PRUSSIA.	AUSTRO-HUNGARY AND BOHEMIA.	SWITZERLAND.	OTTOMAN EMPIRE.
Fifteenth .	A Danish province.	Brandenburg becomes an Electorate in 1486.	Formation first in 1437-38 Loss of Bohemia, 1458 Loss of Hungary, 1462.	Cuddee leagues, 1400, 1424, 1436. Constitution, 1481. Terms in 1499	Stambul taken in 1453. Krim annexed, 1475. Italy invaded, 1475-81. Podolia invaded, 1498.
Sixteenth .	Independent in 1555. Esthonia annexed, 1561.	Part of Pommern acquired.	An Imperial circle, 1512. Protestant and Ottoman wars.	Confederation, 1513. First religious war, 1531. Second religious war, 1553.	Conquest of all Hungary, 1526. Hungary proper is lost, 1571.
Seventeenth .	Protestant wars. Conquest of Pohlen, 1656-60.	Prussia acquired in 1657.	Hungarian re-union, 1606. Bohemian re-union, 1648.	Valtellina lost, 1600. Independence acknowledged, 1648.	Polish war, 1671-82. Vienna besieged, 1683. Losses in 1699.
Eighteenth .	Civil war. Loss of the Baltic provinces, 1721.	Becomes powerful after 1763.	Succession wars.	Huguenots settle, 1685. Third religious war, 1712. Reconstituted, 1738. French conquest, 1793-98.	Losses in 1718. Successes in 1739. European recognition in 1743.
Nineteenth .	Finland ceded, 1809. Annexation of Norway, 1814.	Supremacy in Germany in 1870.	Decline in Germany, 1867 to 1870.	Reconstituted, 1803. Emancipation, 1815. Reconstituted, 1874.	Bessarabia ceded, 1812. Greco evacuated, 1828. Losses in 1878.

TENTH CENTURY

900 TO 999.

PERIOD OF MAGYAR INVASION.

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TENTH CENTURY

900 TO 999.

PERIOD OF MAGYAR INVASION.

GENERAL DEVELOPMENT.

Progress was hardly possible in the present condition of Europe. Every country was either invaded or invading. The Arabs and Moors, or their upper classes, were well educated and scientific according to Arab notions of the time, and this was their period of highest intellectual development. They had good historians and chronologers, astronomers, geographers, surgeons and medical men, that used instruments and knew the use of Indian herbs and anæsthetics, and they possessed large libraries, observatories and colleges at Cordova, Baghdad, &c. The Sicilian Moslems had the same advantages; but there was a chasm between the Moslem and the Christian, and learning did not pass from one to the other; any introductions into Europe through them filtered on very slowly. Even the Byzantine Greeks, who held Asiatic provinces and were partly Asiatic, acquired and introduced very little, and of that even there is some doubt. The Magyars, the last invaders, apparently brought no knowledge with them at all, but came as savage Turkman tribes from Turkestan, probably because they were expelled or defeated there or in Khwarazm or Kipchak, and certainly with the hope of acquiring land and booty.

Europe consisted mostly of the fragments of the temporary Carolingian Empire, which had achieved some little success against the Moslem in Spain and in Italy by using heavily armed troops against the light-armed Saracen; the results were however transient. In this century there were two novelties introduced in warfare, and both of them seem to have been

Anglo-Saxon; one the defence of a markland and frontier, by a series of chains of castles or towers, adopted by Edward the Elder; the other, the employment of a permanent cruising navy, by King Edgar. The former mode was afterwards adopted successfully in Castilla, and in German marklands.

The Danes, generally so successful in attacking towns and forts, had some engines or arbalists of improved sorts, which they used at the Siege of Paris; they also threw leaden balls with them. It is believed that the accidental running of some molten lead from a roof in a burning town led to the notion of using leaden balls by some Dane in Frankland. The details of the improved arbalists and engines are, however, unfortunately not forthcoming. Secret societies and guilds of craftsmen for self-protection are also novelties due to the Anglo-Danes, unless they had existed in Denmark before this century. Personal cleanliness seems also to have been an Anglo-Danish introduction (see Record 991). The Anglo-Saxons, Franks, and Lombards did not bathe.

The hospice of St. Bernard, and the four hospices of Lucca were forerunners of more exclusively medical hospitals, but were also free inns for the distressed and needy. Libraries were yet unknown in Christian Europe, unattached to other institutions, such as priories and monasteries; and schools apart from churches were few. Education was chiefly oral and practical.

Construction and building went on very well; many of the chief towns of Europe were founded or rebuilt in this century, some were walled; in England fourteen towns were rebuilt by monks. Abbeys, monasteries, priories, and nunneries became numerous under the reformed Benedictines, and some churches, though yet few of any large size, were built. In public works, there are two noteworthy things of this century, the harbour improvement works of Tortosa, dating from 944; and the introduction of sewage irrigation into Northumbria by the Anglo-Danes, a mode of sanitary cleanliness never yet surpassed. Some shipbuilding slips were doubtless built by the Anglo-Saxons for Edgar; Billing's Hithe or Haven was also a formed landing-place.

The Fine Arts existed in this century. The Danes and Anglo-Danes had bards, poets and harpers. The Anglo-Saxons too had such musicians, but also had other instruments, notably the fiddle, which seems to have been indigenous. King Aelfred, d. 901, encouraged music. Dunstan, b. 914,

d. 988, introduced improved Church music, and probably organs, Byzantine instruments. The Spaniards had fiddles and guitars. The Moslems had musicians and poets; among them was a notable one, Rûdaki, or Farîduddîn, d. 954, of Bukhâra, who also translated Pilpâi's fables. Pictorial art was not confined to the illuminations or small pictures in manuscripts, like those of Aelfsin, the Anglo-Saxon monk. The monks under Dunstan, chiefly Anglo-Saxons and converted Anglo-Danes, were metal-workers, stained-glass makers, and painters. The record of Roger, also called Theophilos the monk or the presbyter, proves, from his writing about painting, that fine art existed on a larger scale. He mentions colours suited to painting on walls, canvas, wood, parchment, and on glass, and more specially mosaic in coloured crystal (stained glass). He painted in raw linseed-oil and in boiled linseed-oil. He knew goldsmith's work, the damasking and enamelling of metals, and the fixing or setting of precious stones.

The latter arts were Danish, known to Wieland, and to the Finns (see the Eddas); the glass and mosaic were known to Dunstan's monks, and the painting was an art that probably came from Constantinople, with the term presbyter. Roger was a Gothic or Anglo-Danish name, while Theophilos was Greek; the introduction was direct from the Byzantine Empire in the first instance, but developed in England. Italy yet knew not such things, for these Italian Lombards were hostile to Greeks, and tortured and burnt alive Byzantine immigrants as heretics in the following century. England was the earliest home of Fine Art, and developed largely this Byzantine introduction, which seems to have been afterwards lost at its source, and soon lost in England.

The Moslems and Arabs in rare cases, generally of Persian or Indian origin, illustrated their books; and usually deemed music an art suited to the degraded; the higher type of fine art was unknown to them apart from poetry, jewellery, and ornamental buildings.

Leading Moslem Scientists of the Tenth Century.

Abbas Ali, Gabar—Persian— physician <i>A.</i> 980	Kisāi, hakīm—physician 953 to 957
Gabar of Sevilla—astronomer and philosopher <i>A.</i> 965	Muhammad bin Jāfar (Al Batani)—astronomer, inven- tor of sines and tangents 860 to 929
Abul Farāj-Ali—scientist 897 to 967	Muhammad bin Zakkariāh (Rāzi)—physician, astrono- mer, &c. 852 to 932
Abul Kāsim Ubedullah (Ibn Khudādbih)—cosmographer 897 to 912	Sabit bin Kihra—geometrician and translator 852 to 901
Abu Nasr Farāhi (Alfarabius) —cyclopedist of science 897 to 954	Yahya bin Ali (Abu Mansur) —astronomer 855 to 901
Abu Nasr Sabūr (bin Urīsher) —scientist, cyclopadist and historian <i>A.</i> 954	—
Ali bin al Husen (Al Mas- āudī)—traveller, &c., and cosmographer 897 to 957	(NOTE.—The historians, priests, poets, and religious writers, the biographers, metaphysicians, genea- logists, lexicographers, collectors of legends, and romancists, were numerous.)
Eutychius, <i>b.</i> Cairo—physi- cian and analyst <i>d.</i> 950	
Ibn Hūkal—cosmographer and mapmaker <i>A.</i> 977	

POLITICAL CONDITION.

The chief disturbing causes in Europe generally were the Magyar invasion from the Asiatic frontier, the Danish and Anglo-Danish raids and incursions, the aggression of the Spanish Arabs, and of the Tunisian and other Saracens.

Let us first trace the Magyar invasion from 900 to their settlement in Hungary in 958. In 900 the Magyars had been reinforced by a fresh arrival of their men from the Lower Danube and South Ural country into Hungary, where the leaders of 894 had formed a temporary settlement, after expelling the Moravian Slavs and Avars. The reinforced Magyars under Arpad attacked Bavaria, and occupied its markland Austria; they also attacked Frickthall in Aargau. They then invaded Saxony and Oldenburg, and destroyed Bremen; afterwards they invaded Suabia and Franconia, and ravaged North Italy, at this time ruled by Louis of Arles and Berenger. Apparently the first raid on Germany was short, but that in Italy continued until the battle of Albiola, when the Venetians defeated a force of Magyars, and destroyed all their ships, in 906.

The second Magyar outbreak was in 908, when they dismembered the old kingdom, Great Moravia, by occupying the remains of it. Part of it had before become German, and another now fell to Bohemia. It was a conquest of a country of Slavonians, allied to the Czechs, which had become Christian only in 856; the land was occupied till 1062. After this conquest the Magyars conquered and occupied Silesia, a recently annexed Polish province, whose people were Czechs, of a tribe allied to the Bohemian Czechs.

The third Magyar outbreak was an incursion in Germany in 918, specially in Saxony, but in 920 they were expelled even from Austria by Henry I. the Emperor, and King of the East Franks. Some invasion of Italy was going on at the same time and was checked by Rodolf of Burgundy in 921 to some extent perhaps. But in 924 they again ravaged Saxony and

recovered Austria, and in their ravages of Lombardy they burned Pavia with its forty-three churches, the remnant of its people going to Milan; this series of incursions continued till 928, when they received the large payment of ten bushels of silver on agreement to evacuate Italy. They then in 929 attacked Bulgaria and the northern Byzantine provinces.

The fourth great Magyar attempt was in 934 on Saxony, and here they were met in battle at Merseburg by Henry's Saxons, who severely defeated them.

The subsequent attempts were less important; in 940 they ravaged Arlesat (then the kingdom of Burgundy), also Champagne. But it was a year of famine and of civil war amongst the West Franks, hence there was little support for the Magyars; also the Emperor Otho intervened personally to stop the civil war, and probably scared them. In 951 Otho entered Italy and expelled the Magyars, also the meddlesome Burgundians; he gave them their final crushing defeat in 955 at the battle of Augsburg, and put Austria under Burkhardt of Babenberg. After this the Magyars settled permanently in Hungary.

The Moslem invasions and successes in the South of Europe were important in this century. In Spain the achievements of the descendants of the Goths were small and were transient, the Christian kings and nobles obtained territory by their valour only to lose it again before very long. Hashem II., the tenth Ummiad Khalif of Spain, began recovering all in 985, and by 997 even Leon, North Portugal, and Galicia were conquered, and the bells of Santiago de Compostella were taken away as a finishing trophy.

In Italy the Moslem did not lose ground on the whole, and occasionally achieved some success. There had before been a Moslem occupation of Apulia and Calabria from 828 to 890, when the Byzantine Greeks recovered them. Also in 899 the Germans had expelled the Saracens from Rome. In 900 the Sicilian and Tunisian Moslems made a new general invasion of South Italy, while at the end of this century (in 982, 983) they twice defeated the Emperor Otho, and with a Greek alliance maintained their hold on their former provinces. The sacking of Genoa in 936 by the Saracens followed by withdrawal indicates some fear of the Pisan naval power.

The Byzantine empire alone was comparatively fortunate in opposition to the Moslems. Though the town Saloniki was stormed and sacked in 904, and Seleucia was lost, the Karma-

tians, very heterodox Moslems, overran Syria and Arabia, from 891 to 953; the great Khalifat was reduced to the town Baghdad in 937, after the Egyptian Tulunides had seized Syria in 933. The Arab or Saracenic power was thus broken up and diverted; it was hence easy for Phokas to recover Crete in 961, and for Zimisces to recover Cyprus in 964, and the recovery of Cilicia, the taking of Antioch in 966, and Halab in 972, were similar from a political view.

Next as to the Danes, and the Anglo-Danes and Anglo-Norwegians, and their doings in this century. It was an Anglo-Saxon and Frankish mode to treat them generally as freebooting pirates, and to pretend that they were ignorant because their mode of education and instruction dispensed with much writing and reading, while at the same time the Danes were considered foppish, because they bathed and were personally clean (see Record 991). The Anglo-Saxons and Franks had forgotten or were ignorant of past history. The Danes were their ancient rulers, instructors and masters, who raised them from a savage condition. Sigge Fridulfson, last of the Odins, and his sons and descendants, had taught them to sow corn, and to defend and rule lands, and had taught them runes of several sorts, valuable, not as mere clerical learning, but of practical use in war, medicine, seamanship, and other matters. They had supplied them with kings, chiefs, and prince-bishops, and enabled them to show a bold front to the rest of the world; even Rome was sacked by Goths, ruled by chiefs of Danish descent. They had given them a religion of honour, force, effort, and heroic glory, instead of the debased woman-worship of the Venus-Ceres type, that adored Eortha in Heligoland, and survived long in various contemptible habits of the West Franks. The Danes were thus the destroyers of the Roman Empire, and the originators of Modern Europe as a free country, extending from Novgorod with its Varangians to Spain with its Visigoths; they had a general claim on Europe, and special claims on certain chiefdoms and kingdoms which they had established in Eastern Frankland, and in Burgundy, also on some early chiefdoms in Britain, formed before the Saxons of the sixth century made their later settlements, most markedly that of Lindesey or Lincoln and some neighbouring parts. They had also some ports and small kingdoms in Ireland.

To treat the most lordly nation of Europe as freebooting fops was an error of an insulting sort that recoiled severely.

All Europe was harried in the ninth century, and most deservedly ; in England the Danes also formed a large settlement ; Northumbria, much larger than their ancient Lindesey, which had its own rulers, independent of Denmark ; and small kingdoms in Ireland under independent Irish Danes. In the Orkneys and Hebrides round to the Inner Hebrides, the Isle of Man and the North of Ireland, were small Norwegian settlements. The later Anglo-Danish kingdom of East Anglia was formed by Gorm, expelled Prince of Jutland, and grandson of a dethroned King of Denmark, at the end of the ninth century, after the war with King Alfred.

In former centuries the ravagers of Europe were Danes, Goths, and Swedes, with perhaps a few Norwegians, all direct from their own countries ; but in the tenth century the ravagers were chiefly from England ; they were Anglo-Danes, also a few Orkney-Norwegians. By some nations they were termed Ostmen, or Eastmen, by others Northmen ; and, as former ravagers had come from Gothland and Denmark, it was supposed that these also came thence. The causes of the expeditions from England were these : The Anglo-Danes of Northumbria and of East Anglia invaded Wessex and Kent in 904, and were severely defeated near Bury St. Edmund in 905 by Edward the Elder ; both the kings of the Anglo-Danes, Ethelwald and Eirik, were killed, and the Watling Street frontier of the Danelagh was formed. The Anglo-Danes were comparatively few, and badly supplied from ravaged lands, also they received no help from Denmark ; they evidently foresaw their coming subjugation, which took place in 922. Consequently, in the year of the Treaty of Helsingford, 906, when Hrolfr, an earl of the Orkneys, visited Northumbria and East Anglia, he found Borth of Northumbria, and Gorm, son of Eirik, King of East Anglia, willing to join him in an attack on Frankland, where he had lately been unsuccessful. This tripartite expedition conquered Le Maine, Bretagne and Neustria, but was defeated at the Garonne. Gorm ruled as Gurmhaillon, in Bretagne, from 907 to 912. Also in 920, after the battle of Maldon, Thurcytel of the Five Boroughs, with other jarls, asked leave of Edward, and took their men to Frankland. These two cases are known, but many jarls doubtless went at other times without leave ; it was the resource of Anglo-Danes after a severe defeat by the Anglo-Saxons. Hrolfr obtained Neustria in 912, and submitted to fiefdom to the West Franks on marriage and acquisition under treaty. It is noteworthy

that when he refused to kiss the foot of the Frankish king, he spoke English of the time, 'Ne se bi God.' Borth's Northumbrians after being defeated near the Garonne in 906-7, joined Gorm in Anjou and Le Maine, and Hrolfr in Neustria, and contributed to their successes. In 924 the Franks ceded Le Maine to Rœgnald, a Northumbrian Dane, who abandoned and sold his rights the year following, and went to harry Burgundy. But the Anglo-Danish settlement of Western Le Maine remained permanently. The Irish Danes invariably attacked either Caledonia or Wales, and the Severn counties; in one case they went to the Channel Islands with some Norwegians. But Frankland, Burgundy, the Netherlands, and sometimes Moslem Spain were ravaged by Anglo-Danes in this century.

The first purely Danish invasion of Neustria was in 945, when the fleet and army of Harald Blåtand recovered the land for the boy Richard, and formed a Danish regency; the second in 955, when he sent reinforcements.

A migration of Anglo-Danes to Spain and Southern Europe took place in 913, from Neustria, as many would not accept Christianity, and preferred to go; others in 935 and 945.

The small immigration of Suabians and Flemings into England, about 960, was perhaps due to the reconstitution of Upper and Lower Lorraine in 959 by Otto I. Elsass had been joined to Suabia to form a new duchy in 955. Brabant and Luxemburg were newly formed counties, the latter including Limburg and Namur, and detached from the old Kingdom of Lotharingen. Some losses were probably inflicted under these changes. Many of the immigrants were or became canons or monks; they introduced the 'Custom of Metz' at Wells.

The first purely Danish invasion of Wessex took place in 991, and continued till 1001, when Swen received an indemnity and withdrew. It was due to the ambition of Swen, and his wish to help the Anglo-Danes to a less dependent condition; the purpose was achieved, and Wessex was ravaged for ten years; but it was not a conquest. Not only did the Anglo-Danes join the invaders under Justin and Guthmund, but the English fleet and the English army deserted near the beginning. Probably it was all preconcerted against Ethelred, a man doubtless intensely hated for his shiftiness of character.

There were in this century religious wars in Denmark and Norway, chiefly directed against the introduction of Christi-

anity, but perhaps other matters were blended with this. The Karmatian war against the Moslem was also religious. There was also a Christian persecution, ending in the partial disappearance of an important Christian sect — the Culdees, Kildees, or Columbans, the last order of the British Church since 432, existing in Caledonia after 562, as well as in Wales, Burgundy and the Swiss hills and in Frankland; they partly vanish in the tenth century. At some places, Dunkeld, Melrose, S. Andrews, Bardsey, Caernarvon, they merely suffered from Danish ravages; elsewhere they seem to have passed into other sects, or to have merged into them. The persecution of the Paulicians in Asia Minor in 950 and 970 left a small remnant after the massacre of 600 000 persons. They had separated from the Eastern Church in 842 on the matter of rejection of the ancient Jewish Scriptures, but this was perhaps the nominal cause only. The remnant was transported to Thrace and Makedonia in 950 and 970; and out of this arose a really heretical sect, the Bulgarians, after 970; also the Paterini, who entered Italy in 990; these were the forerunners of many later heretical sects, the Cathari and the Albigensis. The Valdenses were quite distinct; they had been revived in 820 in the Cottian Alps, Lucerna, Perosa, and Val S. Martino of Piemonte; and may have been expelled Arians from the year 395, or simply an old local church like the Culdees, that opposed Romish centralisation, or Augustinianism.

The Western Church itself was in a deplorable condition; the chair of St. Peter was not only a purely local Italian institution, but had been, from 898 to 936, a post filled by nominees of two infamous women, Theodora, and Marozia, her daughter. The elections they controlled were, those of Sergius III. in 898, who was restored in 904, and ruled till 911 or 914; that of Giovanni X., also by Theodora; that of Leone VI., 928, and of Stephano VII., 929, both by Marozia; and last that of Giovanni XI., 931, putative son of Pope Sergius III. and of Marozia. This condition lasted till 933 or 936, and was the climax of Italian intrigue in such nominations.

During the period 936 to 963 the Papacy was tranquil, but the deposition of John XII. by council was followed by a series of faction struggles that continued for a century, that deposed, imprisoned and killed Popes and Antipopes. Disregarding the alleged crimes of some occupants, that were fabricated by intriguing Italians, the squabbles of the parties, and the atrocious treatment of opponents, almost Turkish in

atrocities and greed, alienated the esteem of Christendom from the historical Papacy.

The Popedom had seldom received more than external allegiance from Northern nations, after it was understood. Money and support went with little heartfelt reverence.

England sent several envoys to Constantinople, and there was on several occasions much likelihood of the Patriarch superseding the Pope altogether. The Church, that is the people apart from the hierarchy, could not respect the secular canons of Papal nomination under such circumstances. The monasticism of the later Benedictines, active and skilful, if designing and grasping, saved the Western Church. Christianity in Europe, like that of the Nestorians in Asia, would have nearly died out, but for their efforts. They not only maintained religion, but transformed it into a fine art, for the benefit of those incapable of appreciating the original teaching and aim.

In the intervals of political war, there were civil wars in most countries of Europe; even in the smallest of them, the kingdom of the West Franks, when reduced to Champagne.

Famine and pestilence of some sort made periodical visitations to most countries; but little is known about their causes and natures. Doubtless some of the famines were scarcities following war or ravage; but as to the pestilences, it is impossible to learn whether they were like the plague of the fifteenth century, or that of other times.

RECORD OF PROGRESS AND EVENTS

900 TO 999.

PERIOD OF MAGYAR INVASION.

900. **Southern England**—Re-introduction of knighthood by royal dub. The fyrd or militia is improved. Pugilism, horse-races and hunting are re-introduced or encouraged by King Alfred before this time; hawking and athletic games, old British customs, are also revived. The law courts among the Anglo-Saxon English were the Court Baron in any manor, the court-leet for serious charges, and the shire-mote for appeal. There were also market courts for disputes of purchase, and for fair prices. Among the Anglo-Danes, the jarls or chiefs exercised personal jurisdiction over all men in their tribes; and were sometimes Jacks, or Jalks, pontiff-chiefs, and descendants of Odin, holding religious authority. Similarly the gods or Gauts among the Norwegians of Northern Caledonia and the Hebrides. Among the Welsh, Picts, and Irish, the jurisdiction was tribal in conclave under the chief. All these courts had protective power. Any church or shrine was a sanctuary of refuge for three days, some for forty days.

900. **Italy**—At Lucca there are now four charitable hospitals for poor and distressed travellers; one of them founded by foreigners, perhaps Germans, for the benefit of persons of their own nation. They give shelter, food, and medical help.

900. **Arab Moslem**—This is the culminating period in Arab learning and science; it was based on translations from Hindu authors and from Greek authors, and developed by the Arabs to some extent. The leading scientists of the time are mentioned in the list at page 6. Gunpowder was known to them, even if not used; for the Chinese even knew it; the invention was Indian, dated c. 1000 B.C., and used in rockets (bhan) in India; and in cannon, a Chinese invention of c. 757 A.D.

901. **Arab Moslem**—The new Arabic characters are invented by Ibn Makla, wazir. The geometry of Euclid, and many Greek books, had already been translated into Arabic by Sabit bin Kirra, who died this year.

Record of Progress

903. **Southern England**—Case of replacing a lost English title-deed by a memorandum.

904. **Italy**—Restoration of Pope Sergius III., who had been elected through female influence in 898, and soon expelled. From this time till the year 933 or 936 the Popes are nominees of Theodora, or of her daughter Marozia—both of whom were criminal women.

907. **Byzantine Empire**—The Russo-Varangians sack Constantinople.

907. **West Franks**—The joint expedition of Gorm, Boith, and Hrolfr from East Anglia, Northumbria, and the Orkneys, now attacks Frankland; it conquers Le Maine, Bretagne, and Neustria.

909. **Southern England**—The bishopric of Cornwall is founded; Cornwall had been made a jarldom by King Alfred, but it had a local government, and usually joined the Anglo-Danes, when there was an attack on Wessex.

910. **Byzantine Empire**—The amended Basilican code is issued; this was originally drawn up in the year 884; and is the earliest complete code of modern times, and the longest in use, continuing till the fall of the Empire.

911. **East Franks**—Entire close of Carolingian supremacy at the death of Louis IV. the child. Konrad of Franconia is elected king of the East Franks or of Germany.

911-12. **Neustria**—Orkney-Norwegian and Anglo-Danish permanent settlement under treaty of Clair sur Epte.

912. **Byzantine Empire**—First recorded commercial treaty of modern times, made with the Russian dukes, or with Oleg, regent for Igor I.

912. **Arab Moslem**—Geography and history have now been studied; Ubedullah Khurdadbih dies this year, after having largely added to the stock of knowledge.

913. **Holland**—Accession of Theodor, first count. The Danes had been defeated in Brabant by Arnulf in 891; they did not return, as they did not like lowlying lands.

915. **Italy**—Pope John X. defeats the Saracens and drives them back from the Garigliano.

918. **Southern England**—The treaty of York, made by Ethelfleda for her brother Edward the Elder, with the Anglo-Danes leads to the first union of Anglo-Saxon with Anglo-Danish England.

919. **Germany**—Henry of Saxony becomes Emperor, and under him, after 925, Germany became powerful. It remained so for about a century, or till the humiliation at Canossa of Henry IV.

921. **Byzantine Empire**—The Bulgarians under Simeon sack Constantinople. Bulgaria became a vassal state in 850.

923. **England**—FIRST UNION OF ALL ENGLAND; including all Anglo-Saxons, Anglo-Danes, and Welsh of England; also the Silurian Welsh of Wales, the Strathclyde Welsh, and the Scots.

Record of Progress

925. **England**—Retreats are built for sheltering travellers from wolves ; there is one at Flixton.

926. **England**—A secret society, afterwards termed the Grand Lodge of York, is formed, with the aim of mutual protection ; it is the reputed basis of the English masonic brotherhood.

928. **Iceland**—This Norwegian colony now adopts a republican government, and the laws of Úlflöt.

929. **West Franks**—Close of the Capitularies of the laws of the Frankish kings under Charles III. the Simple.

929. **Arab Moslem**—Death of the astronomer Al Batáni, who made star charts, and wrote treatises on the zodiac and the stars, a science of Hindu origin ; he invented sines and tangents.

932. **Arab Moslem**—Death of the scientific surgeon Muhammad bin Zakkaria Rázi ; he had removed cancer and tumour without the knife, and had treated hernia successfully. He used actual cautery, also the Indian anæsthetics, Indian hemp, datura, &c. Some of his processes were of his own invention, others were Indian, for he translated many books from Sanskrit. He advocated hydropathy, and wrote on small-pox.

933. **Ireland**—The Irish annals of this year mention crannoges, or fortified islands of retreat.

934. **England**—Monks of the order of S. Benet are largely introduced by Dunstan. Some reforms had been introduced among the Benedictine or Black Monks in 900 by Pope Benedict IV. They had been founded in 480, and had before entered England in 596. The new order was an active skilful monasticism.

936. **Italy**—Election of Pope Leo VII. independently of female influence, after the death of Marozia. The Papacy begins to rise from its abject condition after this time. The Saracens pillage Genoa. (They had been expelled from Rome by the Germans in 899.)

937. **England**—*Second union of England*, after the battle of Brunanburgh, won by Athelstan. It is supposed that the Anglo-Danes of Northumbria now first accept Christianity.

938. **Bretagne**—Alain Barbetorte obtains Anglo-Saxon troops from Athelstan ; they recover Dol and Nantes from the Anglo-Danes there settled, and invade Le Maine in 940.

940. **England**—Edict of Athelstan ordering attendance at Church on Sundays and holidays. The veneration and decoration of wells and fountains is forbidden ; the custom was probably of pagan-Romish introduction. Craft-guilds, probably Anglo-Danish, now exist ; but it is supposed that guilds for purposes of trade did not rise for many years afterwards.

942. **Byzantine Empire**—Second partial recovery of Apulia and Calabria from the Saracens, lost in 900.

944. **England**—The custom of invoking dead saints is admitted by canon of the English Church. This had been a Romish custom since the fifth century ; but it was also Danish (see Grougaldre) ; and the Archbishop of Canterbury was Odda, an Anglo-Dane.

Record of Progress

945. **England**—*Third union of England*, after the defeat of Dunmail by Edmund. These Welsh migrate to North Wales.

950. **England**—Rise of many monastic towns, built by monks on the ruins of former towns and places destroyed in the Anglo-Danish wars, and in the invasions of the ninth century.

950. **Le Maine**—The Anglo-Danes of Western Le Maine succeed in expelling the Britons, and defending their western frontier.

953. **Italy**—Early mention of heraldry in Italy; Tebaldo Martinengho obtained on 6th August, 953, a grant from the Emperor Otto I. of ten castles in Brescian territory, with the right to bear as arms, a red eagle in a gold field.

954. **Arab Moslem**—At this time flourished Abu Nasr Sabúr (bin Urdsher), founder of a scientific and literary institution, also of a library of 10 400 volumes, at Baghdad. This learning spread into Moslem Europe, Spain, Sicily, South Italy, &c.

958. **England**—Rebellion of monks in large numbers; they are replaced by secular clergy or canons, and expelled with Dunstan their leader.

957. **Arab Moslem**—Death of the great traveller and historian Al Masaudi, who had visited India, Ceylon, and China, and written many large books on that subject.

960. **England**—King Edgar largely increases the navy; he commands it during cruises about the narrow seas. Immigration of Suabians and Flemings. The monks return.

960. **Flanders**—Woollen cloth is made in large quantities, and perhaps exported to Germany. Fairs are now largely instituted; they existed before at Aachen and at Troyes, also in England since 886 or before.

961. **England**—*Fourth union of England* under Edgar.

962. **Savoy**—The S. Bernard Hospice is founded by De Menthon, a Savoyard nobleman.

962. **Italy**—The Emperor Otto I. of Germany is crowned Emperor of the Holy Roman Empire by the Pope.

963. **Italy**—A Council deposes Pope John XII. with Imperial consent, and elects Leo. VIII. The troubles of the Papacy caused by Italian factions begin and continue till about 1060, when the mode of election was altered.

964. **England**—Charter of Edgar, claiming authority and jurisdiction in the narrow seas. In the case of an alienated manor, King Edgar, at the request of Dunstan, confirms the lands of the manor of Grenawic to the abbey of S. Peter at Gand, in accordance with a previous assignment.

965. **Italy**—Early case of expulsion of a pope for insolent domineering. The Romans expel Pope John XIII.

967. **England**—Foreign traders, probably Flemings, settle in London, to buy cloth and wool. The English wool is now the best. Reputed formation of a guild of saddlers at London. *See* 940.

968. **Flanders**—Weaving is introduced at Gand; it had existed at Bruges, the capital of the Counts of Flanders, for some years. It is

Record of Progress

supposed that exiles and outlaws from England introduced it, as such usually went to Bruges ; also that, on the destruction of Winchester the old seat of manufacture, by the Danes, the craft was carried to Flanders. Afterwards Flanders and England together supplied cloth to Europe.

968. **Italy**—The great bell, John, of the Lateran church is cast and consecrated by Pope John XIII. ; restored in 967.

969. **England**—Hanging is the punishment for night-thieves. freebooters, and pirates caught in the act ; but is never applied in other cases. Lay-parishes are now mentioned.

970. **Kipchak**—Bighu Khan, ruler of Kipchak in Europe, expels Saljuk and his tribe, who then go to Bukhara ; apparently the descendants are the conquerors of Persia and Syria, 1013-1074.

971. **Byzantine Empire**—Battle of Dorystolon ; final defeat of the Russo-Varangians, who had attacked the Empire often since 865.

972. **Germany**—Gold is discovered in Hannover and in Saxony about this time.

972. **Magyars**—The Magyars have now permanently settled in Hungary under Geysa.

975. **England**—Thurcytel casts a very large bell, named Guthlac, for Croyland Priory. Uniformity of measure according to Winchester standard introduced by King Edgar. The extirpation of wolves in many parts of England is nearly completed. Some law to suppress drunkenness is passed. Apples now grow wild in England. Free education is given to children by the mass-priest at the parish churches ; the priests may receive free gifts but may not ask for them ; they are also forbidden to entice any scholar from the instruction of another teacher.

978. **England**—Early mention of a Convocation of the State of the Scottish realm at Lanark.

979. **West Franks**—The coronation oath of King Ethelred of England, taken this year, is very similar to that taken by the king of the West Franks. (It is extant.)

980. **Denmark**—The Odinic religion is restored at the expulsion of Harold Blåtand, who had accepted and introduced Christianity in 975.

980. **England**—General conversion to Christianity of the inhabitants of the jarldom of the Orkneys.

981. **Germany**—Gerbert, from Urillac Auvergne, born 930, is retained by Otto II. as tutor to his son. Gerbert had already studied in Spain under learned Arabs. He introduced Arabi numerals (originally Indian) into Europe instead of Roman numerals, perhaps about this time. He became Pope from 999 to 1003 as Sylvester II.

981. **Byzantine Empire**—An invasion of Bulgaria by Basil I. defeated by Samuel.

982. **Italy**—Earliest formation of the republic of Bologna ; town anciently called Felsina or Bononia. See 928.

Record of Progress

984. **Italy**—War between rival Popes, Boniface and John XIV. First Venetian attack on Dalmatia, partly peopled by Serbs and Croats, but lately held by Narentine pirates (Bosnians).

987. **West Franks**—Titles of nobility become strictly hereditary, and apply to all the sons of all nobles, under the ordonnance of Hugh Capet. Peers had been established in 778, but their younger sons had hitherto been untitled gentlemen, as among the Anglo-Saxons.

990. **England**—Pillions and chair-seats on horseback are now used by women. Rain-screens or umbrellas are unknown. (An erroneous supposition is based on an illustration in the Utrecht Psalter, and on MS. No. 603, B. M. Lib., in which a Tyrian umbrella is held over David at the dedication of the temple.)

991. **England**—First payment of Danegeld by Ethelred the Redeless, 16000*l.* of silver. Bathing and personal cleanliness is introduced in Southern England by the Anglo-Danes and Danish Danes. They bathe after a journey and on Saturdays, and daily comb their hair and keep their dress in order; this is deemed a foppish vanity by the Wesscx folk, who never bathed, and merely washed hands and faces. (*See* 'Liber Elliensis of Thomas of Ely,' and 'Hist. Eliensis apud Gale and Chronicle of Ramsey.') The Danes had also introduced sewage irrigation in Northumbrian villages.

995. **Arab Moslem**—At this time died wazir Ismail ibn Ibad, owning a library of 112000 volumes. In this year also Abu Hass Umar bin Ahmad, the author of 330 works, died.

997. **Spain**—Loss of all Christian Spain except Asturias and Navarra to the Moslem. Leon, obtained in 722, was lost in the campaign of 995-997; also New Castilla acquired in 912; and Galicia and Lusitania acquired in 876, and partly in 952. The county of Aragon joined to Navarra in 905 is also lost.

998. **Spain**—Battle of Osuna won by the combined Christian princes, who now begin to recover their territories.

998. **Italy**—The Venetians conquer and annex Illyria and Dalmatia, Byzantine provinces.

998. **Norway**—General conversion to Christianity, first introduced in 941; destruction of the temples of Drontheim.

999. **England**—The hierarchy of bishops and abbots becomes powerful, and carries out the Augustinian principle of centralised domination at Rome.

999. **Italy**—Mariolatry and the Lesser office is introduced; this pagan revival afterwards spreads throughout Europe (though the Collyridians of the fourth century had been condemned). The rosary, of pagan or Hindu origin, is now used. (The canons of Chelsea of the year 816 mention belts of paternosters.)

DISCOVERY IN SPECIAL BRANCHES.

Chemical Separations and Discoveries.

Aquafortis, corrosive sublimate, and red precipitate were known to the Gabar, Abu Mûsa of Marân, in the eighth century.

(NOTE.—There were three notable Gabars.)

Exploration and Settlement.

982. Greenland is discovered by Norwegians from the colony of Iceland.

983. Hari Marson is driven by a storm to White Man's Land (Virginia), or Great Ireland.

984. Bjarn Heriulfson, on a voyage from Iceland to Greenland,

is driven by a storm to Newfoundland and C. Breton.

986. Labrador, and perhaps Newfoundland, is discovered by Norwegians from Iceland.

(NOTE.—Iceland had only been re-discovered in 860 and 864; and settled in 872. The Norwegian occupation of the Orkneys and Shetlands began in 875; and of the Hebrides in 881.)

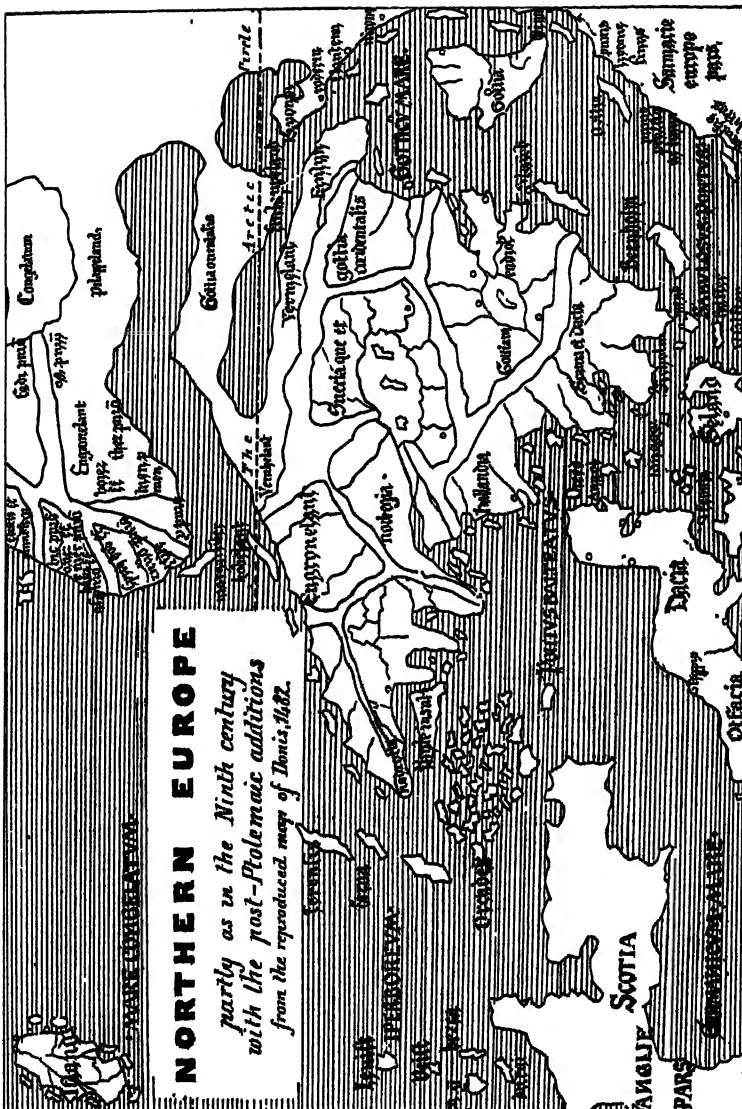
Norwegian Settlements.

946. In parts of Westmoreland and Lancashire.

996. Under Jarl Sigurd in Caithness and Sutherland.

999. In Ross and Murray.

partly as in the Ninth century
with the post-Ptolemaic additions
from the reproduced map of Denis, 1482.



ELEVENTH CENTURY

1000 TO 1099.

PERIOD OF THE DANISH CONQUEST.

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ELEVENTH CENTURY

1000 TO 1099.

PERIOD OF THE DANISH CONQUEST.

GENERAL DEVELOPMENT.

THOUGH the political condition of Europe was generally favourable to progress, this was yet merely progress of a special sort. Nations strengthened themselves, and became more prosperous; there was less misery, penury, and starvation than there had been before; more crops were raised, larger barns and houses were made, more men could be put in battle array; progress at first took the simple form of expansion. And when we reflect on the miserable condition of the people of Europe in the eighth and ninth centuries, even in the tenth, the natural course seems to be this very expansion. The sciences were still retained by the Moslems; even the commoner and rougher paths of progress were little explored. An Armenian prince, Gregory Magisdros (1020-44) translated the geometry of Euclid; otherwise known only in Constantinople among Christians. Franco of Liège and Wilhelm of Speyer were mathematicians. Simeon Sethus of Constantinople translated Oriental books, and wrote on dietetics. Constantine Afer of Carthage introduced into Italy the Oriental methods of pharmacy, and perhaps some chemical processes. In England druggist's work and herbalism were well known, as the work (dated 1066) of Anglo-Saxon Leechdom and Wortcunning (extant) still shows. Hospitals were novelties, of which, perhaps, there were about six in Europe; the preparation of drugs was a household matter.

Windmills were new in 1040, and tidal water-mills for corn grinding in 1044. A cadastral survey was also new in Europe.

Doubtless the Moslem looked on the European Christian as a semi-savage; hospitals, dispensaries, libraries, all existed at Baghdad, and the knowledge they afforded was also gleaned by the Moslems in Europe. Apparently the only useful things of the Christians, in which they excelled, were the best Flemish cloth made of English wool, and the linen.

The discovery of America by Norwegians from Scotland is one of the features of the age; apparently various timbers, specially maple, were transported from the settlement into Europe for some time after, till the colony was entirely neglected. The fate of the *Almugavarez* is a speculative subject; they may have crossed the Atlantic, or may have been driven to the West African Coast or islands near it. The fact of grapes then growing in *Vynland* (Massachusetts) has a curious analogy with the existence of many vineyards in England at the cadastral survey of 1080-86; for both of these things are now non-existent, and lead to the notion that the climate in both places was then more favourable to the growth of the vine than now. There are eight counties so mentioned in the survey, and six others where vineyards certainly existed from some early period. It is known that English wine was made till 1154, when Bordeaux wine was imported, and it is supposed that distillation was unknown in England till 1150. Hence there is the alternative; the art of making good wine from immature grapes may be a lost art, the climate may have altered sufficiently to account for the difference; or the older vines were more hardy.

Education now took a new form throughout Europe; the Latinity of *Lanfranc* introduced from Pavia and Bologna was its basis, and it was very unfortunate, for it brought little knowledge and no science with it; yet, as long as Latin was to be the common language of books, it was better that it should be known. The schools and colleges of this period were all attached to monasteries and abbeys, and the instructors were invariably priests or monks. A Latin mass was their aim.

Construction and building followed the same course as in the last century; new towns were built in many countries, and many large cathedral churches on which lavish expense must have been incurred. The special feature in England was the great number of large parish churches built about the year 1005 and early in the century; also the numerous new castles, abbeys, and monasteries were built in most countries in large numbers. In Italy, *Jacopo* built two bridges at Florence,

besides churches and palaces ; and in England the first stone bridge was begun at Bow in 1087.

The Fine Arts made much progress by way of external adoption in this century ; there was more of it than before, but probably little improvement or higher refinement in quality.

The improved gamut of Gui d'Aretino d'Arezzo drew some attention to the mathematical side of music ; Pope Giovanni XIX. (1024 to 1033 broken) invited Gui to Rome and eagerly encouraged him. Perhaps greater exactitude in tone may have resulted. Franco of Liège continued (1047 to 1083) this development of the gamut. Church music may have improved, because it was more encouraged. The singing and orchestral galleries of English churches of the period have carved on them instruments of various sorts, proving that expense was not spared in Church music, though its quality may have been curious, or even quaint. At Bruges and other Flemish towns there was some analogous development.

Painting was still an art confined to England and Constantinople ; but it was decorative, and an integral part of the builder's or architect's work.

Similarly with regard to sculpture ; there is neither in England, where such sculpture was existent, nor in Italy, where it apparently yet did not exist, any record of a sculptor's name. Jacopo di Lapo, the *magistratus comacinus*, who was engineer of bridges, architect of palaces, and builder of churches (fl. 1035), is not mentioned as a sculptor in any record. The niched figures of kings, evangelists, and saints of the screens and walls of English churches, which now exist, were done by sculpturing monks or others, as part of the architecture under the architect. The sculptor himself ranked as a stone-cutter or mason.

Similarly also the English painter in oil, however excellent his decorative panels might be. As for their quality, there is now merely the analogy with the niched sculptures that can indicate to us what they probably were ; for their remnants have long ago peeled off, or sunk into dull black, in the few cases of survival.

As to architecture itself, Di Lapo built in the so-called Gothic style, which with him was Lombard. In England there was only the steady development of the older Gothic with rather lighter construction towards the end of the century. The theory of a Norman style is a fiction, which the comparison of

the large English parish churches of the beginning of the century, with the cathedrals specially built by or for Anglo-Normans at the end of it, will eventually cause to vanish. The importation of Caen stone was Norman, so was the fiction of Robert Wace, the panegyrist, about a Norman conquest, developed out of a single comparatively small battle.

The poets of this century were few among the Christians, though numerous among the Moslem. They were, Ascalinus Adaberon, who lived at Laon; King Harald Hardrada; Gregory Magisdros, the Armenian prince; and William, Duke of Guienne, fl. 1096, the song writer and first of the troubadours, and perhaps a few more. There were also many versifying chroniclers, whose productions were not poetry.

Leading Moslem Scientists of the Eleventh Century.

Abdul Malik ibn Zuhr (Avenzoar), of Sevilla—surgeon, physician, pharmacist, toxicologist, bronchiotomist, dietetic writer, &c. 1069 to 1161
(NOTE.—His grandfather, father, and his son were physicians.)

Abu Hámid Ghazzali, of Tus—scientist; author of ninety-nine works . . . 1058 to 1111

Abul Kásim Kāláf bin Abhaz (Abulcasin)—Spanish-Arab physician; author of books on medical practice . . . *d.* 1107

Abul Kásim, ul Zahrawi—Arab.-Spanish physician, surgeon, and author . . . *f.* 1085, *d.* 1122

Abul Kásim 'Unsári of Balkh—scientist and philosopher . . . *d.* 1049

Abu Ra'hán, al Bírúni (Alberoni) Muhammad bin Ahmad—astronomer, geometer, cosmographer, traveller . . . *f.* 1030, *d.* 1039

Abu Sina (Avicenna) b. Bukhara—astronomer, mathematician, physician, botanist, zoologist, hygienist, dietetic author, &c. . . . 983 to 1037

Ahmad Abu Jāfar—Arab physician, cosmographer; wrote a traveller's guide . . . *d.* 1080

Al Hazin (Alhazen) Arab—lived in Egypt; scientist, writer on optics and refraction *d.* 1038

Ibn Yunās—astronomer, who observed three eclipses with accuracy; improver of astronomy . . . *f.* in Egypt 1040

Ismail bin Hassan Jurjani—physician, writer on medicine, &c. *f.* 1060

Nasir Khusro Hajjáb, of Isfahán—scientist and physician, hydraulician, writer on waterworks of Jerusalem, &c. *f.* 1052

Sanai (Shekh Nakim) of Ghazni—physician 1069 to 1131

'Umar Khayám, Nushapuri—astronomer, anti mystic philosopher poet . . . *d.* 1123

'Umar of Sevilla—Arab astronomer, physician, philosopher *d.* 1071

Leading Christian Scientists of the Eleventh Century.

Constantine Afer, of Monte Cassino and of Carthage—scientist, physician, introducer of Oriental pharmacy, traveller *d.* 1087

Franco of Liège—mathematician, improver of music . . . *f.* 1047 to 1083

Gui, of Avezzo—improver of musical notation, &c. 995 to 1040

Gregory Magisdros, lived at Constantinople—translator of the books of Euclid . . . *f.* 1020 to 1058

M. Pællus, b. at Constantinople—transl. of Aristotle's works, writer on arithmetic, geometry, astronomy and music *d.* 1079

Simeon Sethus, lived at Constantinople—Orientalist, and writer on dietetics . . . *f.* 11th centy.

William, termed of Speyer—mathematician *f.* 1081

POLITICAL CONDITION.

The external political condition of Europe was generally very favourable to progress and development. There was not any Asiatic invasion, and the last invaders, the Magyars, were settling down like neighbouring European nations. In Spain the Christians were successful in freeing the land north of the Ebro by the end of the century, and in this they were favoured by the Moslem civil wars and disruption of territories. In Sicily the Guiscards had freed the land from the 'Tunisian Moslem by 1090; South Italy having been clear in 1053. The Byzantine Empire formerly had Asiatic possessions, and had recovered Jerusalem in 1031, but could not protect pilgrims in 1062, of whom 70 000 were killed or enslaved; nor even protect Jerusalem, for in 1074 the Saljuki Turks conquered all Asia Minor and deprived the Byzantines even of access. Europe was now comparatively strong and undertook the task, and the First Crusade established three Latin princedoms in Syria. The maintenance of these princedoms seemed at first to be comparatively easy, for the difficulties of colonisation, the climate, the paucity of European settlers, and the numerous hosts that Egypt and Asia Minor could send forth, were matters that had not received attention.

Within Europe the causes of strife were comparatively few; the usual efforts of some encroaching nations to acquire more territory, the attempts to subdue savage marauding people, as the Vends of Jomsberg, Mecklenburg, Pommern, and the tribes in Livonia and in Prussia, and lastly the arrogance and mischief-making of Popes, that encouraged revolt, rebellion and war, in order to acquire importance for themselves.

In the wars between Hungary and Venice, and between Genoa and Pisa, the causes of conflict were matters that could have been decided without bloodshed. The Frankish attacks on Neustria were made with the selfish aim of annexation, and with the specially mean object of taking back a territory already given. The wars between the Byzantine Empire and

the Guiscards were inevitable, without some cession by one side or the other. Venice was, however, an encroaching state, without any cause of quarrel with the Guiscards or with the Hungarians. The subjugation of Norway by Denmark was the justifiable recovery of a former revolted province, while the Danish wars against the Vends and Letts of the Baltic were necessary to stop the piracies of these savage tribes.

Among the more notable political changes were the Flemish leadership in the First crusade, to which most European nations sent contingents, and the rise of Pohlen as a nation. The Lechs were an obscure race, that even took a peasant (Pias) for duke or leader in 842, and opposed some Saxon aggression in 968 soon after the conversion of their Pias to Christianity, also the aggression of the Russian duke Vladimir in 986. In fact, they could just hold their own under favourable conditions. Yet these Lechs became a powerful nation for more than a century, from 1013 to 1138, by preying on their neighbours at convenient opportunities. Afterwards there was a collapse for a longer period.

Germany was weakened by civil war and dissension; Hungary and Bohemia were detached countries; the Russian dukes were still weak; hence the Polish success. Yet in the interval, 1027 to 1041, Pohlen suffered severely. Afterwards Bohemia was restrained by the German Emperor, and the attacks on Hungary during its successive difficulties were easy; similarly that on the Russian duchies in 1067, when convulsed with civil war.

The Byzantine Empire was rather fortunate in this century; though it lost Apulia, Calabria, and a few Sicilian towns to the Guiscards, these were territories which it could not retain against the Tunisian Moslem. But the reconquest of Bulgaria in 1014, after a chronic series of Bulgarian attacks from 893 to 996, was a great achievement; and its annexation in 1018 was followed by only one great outbreak in 1040. The defeat of Jaroslav I. of Novgorod in his attack on Constantinople, ended the series of Russian invasions in 1043. Armenia was acquired in 1046, but lost to Alp Arslan in 1065-68 temporarily, when Georgia was separated. The final Persian conquest was by Malik Shah in 1086. The losses in Slavonia, Dalmatia, and Croatia were not very serious, and the recovery of Asia Minor in 1099 soon after its loss in 1074 was done at the expense of Europe.

Religious war existed in Denmark only from strong opposition

to Christianity. The persecutions of the North Italian heretics was yet on a small scale, though very cruel. Many Vaudois immigrated to Bohemia in 1076.

The Popedom itself was the cause of civil war in Italy and Germany. From 963 to 1059 it had been the sport of Italian factions; but when the new mode of election was adopted, the Popes felt secure, and became defiant. They first dispensed with the customary Imperial sanction, and then opposed the right of monarchs to appoint clergy to benefices in their own kingdoms. Formerly they were mere Exarchs of Ravenna and five other towns; now they had become Dukes of Benevento, and raised standing armies of their own. Pope Gregory VII. went to the extreme; he released the subjects of the Emperor from allegiance, humiliated him at Canossa, and set up Hermann of Luxemburg as a rival Emperor. The result was the embroilment and intermittent civil, or semi-religious war, that began in 1083 with the expulsion of Gregory VII., and lasted nearly till the extinction of the Hohenstaufen dynasty in 1254. The Popes having once interfered between monarchs and their subjects, continued it, as shown by the long series of interdicts on nations, and the giving away of crowns, begun in 1073. Formerly their legitimate extreme was to excommunicate individuals, monarchs and others; now they delighted more in cursing than in blessing, and did it on a very large scale. Europe did not prosper under such theocratic terrorism; and the mere fact, that a group of Italian clergy could appoint a series of Popes to defy all Europe for nearly two centuries, seems now most extraordinary. Yet, with the exception perhaps of the period 1130 to 1181, it is roughly true.

The Hungarian outburst against Christianity caused some years of religious war, with which political matters were blended; for it was also an opposition to German intrusion.

Purely civil war was generally of a tribal sort, or caused by difficulties about succession. The composite nations, in which various peoples had lately united, had the special disadvantage that a civil war might in them arise at any time from some comparatively small incident. This was most specially the case in England, where the Welsh, Anglo-Saxons and Anglo-Danes had been united without much firmness, and outbreaks were perpetually recurring; and where there were also the other disturbing elements, the Irish-Danes and Irish, the Norwegians and the Caledonians, and the Normans, or Neustrians, from beyond channel, who were chiefly of Anglo-Danish, Danish

and Orkney-Norwegian descent. The result in England in this century was most desolating, from the ultimatum of conditions. A Danish conquest placed a Danish dynasty from 1023 to 1042; the whims of the Anglo-Saxons then placed on the throne the most treacherous and unpatriotic of monarchs, who deliberately weakened England in every possible way in order to let it fall a prey to his cousin of Neustria. The Normans, after occupation, introduced a brutal system of oppression and Frankish feudal tenure that transformed England into a hell among nations. Had it not been for this series of disasters and miseries, England would have been the country in which most progress and development would have taken place.

Ireland was more unfortunate. It became independent of its former rulers, the Irish-Danes, who had governed from the time of Thorkill, 831, at Armagh, Dublin, and other centres, but had received little support or reinforcement from Denmark. The result of the independence acquired in 1014, was a chronic state of civil war,—from 1023 to 1064, and from 1086 to 1108. The O'Briens were nominal kings of Ireland in 1014 to 1022, and 1064 to 1086, that is for about a third of the time; but they actually ruled only two provinces out of four—or five, if Clare be considered one of them, as it often was. The political condition was that of African savages. The succession wars in Hungary, and the petty wars in the Russian duchies, left them the prey of Polish invaders, but their political condition was far superior to that of Ireland.

Famine and plague harassed Europe, and on one occasion reduced its population to a half in three years; but the nature of that plague is unknown or obscure.

RECORD OF PROGRESS AND EVENTS

1000 TO 1099.

PERIOD OF THE DANISH CONQUEST.

1000. **Norway**—Discovery of Vynland (Massachusetts) by Leif, son of Jarl Eirik the Red, from Iceland.

1000. **England**—Strong opposition is made to the new dogma of transubstantiation as idolatrous.

1000. **Germany**—Fairs are now instituted for the sale of captives and slaves. It is likely that these were captives taken by the Danes in the invasion of Wessex from 991 to 1001; but there is not any proof of it; such were usually taken to Ireland. There were in Germany persons reduced to slavery by custom or edict.

1000. **Lithuania**—First settlement of Letts in Lithuania proper; it is not known whence these pagans came; they were serpent-worshippers, but the period of their entry from Asia into Europe is not determined.

1000. **Gascony**—First formation of settlement of the Cagots of Gascony and Navarra; it is supposed that these were descendants of fugitive Arabs.

1000. **Italy**—Arabic, or modified Indian numeral figures, are introduced in Italy by Gerbert, Pope Sylvester II.; hitherto special letters had been used both by Greeks and Romans, and in Europe since the fall of the Empire. *See* 981.

1001. **Swedes and Goths**—Christianity is introduced in Gothland and among the Swedes by Olav Skotkoning. Runes or runic letters are used by Goths and Swedes till this time.

1001. **England**—End of the first Danish invasion.

1001. **Italy**—Revolt of Rome against the Emperor Otto III., in defiance of the Union of 964 A.D.; the Germans within the walls are massacred, but the town surrenders eventually.

1002. **England**—Ethelred marries Emma of the Capet family maternally; through whom many Franks and Neustrians are placed as reeves and bishops in England; and cause many Frankish customs to enter, besides Frankish language. Generally accepted date of the last Anglo-Saxon chronicle; yet it was continued later.

Record of Progress

Rise of clanship in Caledonia, formed by Norwegian settlers. Massacre of Danes on S. Bride's day, 13 Nov. 1002, in Wessex and Mercia, in which Gunhild, sister of Swen, is killed.

1002. **Italy**—Revolt of Lombard cities; Arduino of Ivrea is named king. Genoa now rises as a commercial republic and rival to Pisa. The naval and commercial power of Venice much increases from this time.

1002. **Bohemia**—Invasion and massacres by the Polacks of Mescho; afterwards by Boleslas Chobri, lasting from 1002 to 1006; atrocities, blinding, &c., accompany this.

1003. **England**—Second Danish invasion, 1003 to 1007, of Swen for vengeance and plunder.

1004. **Hungary**—Transsylvania, a land very thinly peopled by Avars, is annexed by the Magyars.

1005. **Sicilian Moslems**—Attack on Pisa.

1006. **Europe**—Terrible pestilence throughout Europe, and perhaps throughout the world for three years, 1006 to 1008; it is supposed that half the population of the world was killed.

1006. **England**—Close of the second Danish invasion by payment of Danegeld in 1006–1007.

1008. **England**—Decree of the Witenagemot that every 310 hides of land must supply a ship; a large fleet is formed. Danish demand for an annual tribute; this is refused.

1008. **Sicilian Moslems**—Attack on Capua; and further advance in Italy.

1009. **Friesland**—Ravage and devastation by Danes, perhaps also by Norwegians.

1009. **Spain**—First union of Spanish Christians with the Spanish Moslems and Arabs of the Ummiad Khalifat to oppose a Moorish invasion; the battle of Akbat al Bakr, near Kordova, follows.

1009. **Egypt**—All the churches of Jerusalem and the cave of the Sepulchre are destroyed by Hakim, third Fathemite Khalif of Egypt.

1010. **Norway**—Voyages of Thorfinn, Snorri, and Thorhall to Vynland, Markland, and Helluland.

1010. **England**—Third Danish invasion, 1010 to 1011; closing with a payment of Danegeld; many captives are taken in Kent and are sold as slaves.

1012. **Sicilian Moslems**—Pisa is invested.

1013. **England**—The Anglo-Danes invite Swen to reign over all England. Fourth Danish invasion. **DANISH CONQUEST OF ENGLAND** by the Danes of Swen, the Anglo-Danes of Northumbria under Uhtred, and of the Five Boroughs and Mid-Anglia.

1013. **Pohlen**—Invasion and ravages of the Polacks, under Boleslas Chobri, in Saxony, and North Germany as far as Holstein, also in Pommern and Prussia for three years. The Polacks are expelled from Bohemia by burning the forests in 1016. But the conquests in North Germany and Bohemia ended at the peace of Bautzen in 1018. The conquest and annexation of the Duchy of

Record of Progress

Red Russia followed in 1019. The aggrandisement of Pohlen dates from this time ; hitherto it had been a petty country.

1013. **Italy**—Final suppression of Arduino by the Emperor ; Lombardy and Piedmont return to allegiance.

1014. **Flanders**—Great inundations, and much destitution.

1014. **Byzantine Empire**—Atrocities on the Bulgarians, after the Battle of Zetunium, won by Emperor Basil II. ; he causes all his captives to be blinded.

1014. **Spain**—Emigration of the Almagavarez from Lisbon to seek new lands beyond the Atlantic, the results are unknown.

1015. **England**—Knut is opposed by Ethelred, and by Edmund Ironside, 1015–16 ; but peace is made at Olney, and at the death of Edmund, Knut becomes king of all England, and the Danish dynasty is established in 1017.

1015. **Russian Duchies**—Division of territory at the death of Vladimir I., under whom Christianity was forcibly introduced among the people in 988 to 1015.

1016. **England**—The sale of children is forbidden ; and the outlawry of adulterers is ordained.

1017. **England**—Coronation of Knut again, as king of all England, at S. Paul's Church in London.

1017. **Languedoc**—Rise of the Albigeois ; it is supposed that their tenets were derived from the Paterini and Cathari of North Italy.

1018. **Norway**—Olav II. and Olav Skotkoning determine the frontier of Norway and Sweden by casting dice.

1018. **England**—The laws of Edgar are renewed by the Witenagemot at Oxford.

1018. **Italy**—First entry of Neustrian Danes ; they help Melo of Bari in a revolt against the Byzantine Empire.

1019. **Norway**—Olav II. enforces Christianity on the nobles and people by fine, plunder, and death.

1019. **Moors**—Yahya bin Ali introduces a large tribe of Moors (their first arrival in Spain) to support his claims.

1020. **Norway**—The Norwegians of Olav Haraldsen invade Scotland, and occupy a large part of it ; driving Malcolm southward. The Norwegian conquest of Caledonia dates from this time as reaching its fullest development. Malcolm II. and the Scots settle in Valentia, ceded to them, after their defeat by Knut.

1020. **Saxony**—Year of very severe pestilence.

1022. **Norway**—Olav the Saint persecutes the Norwegian pagans with fine, maiming, and hanging.

1022. **Italy**—Some Manichæans are burnt alive by order of Pope Benedict VIII., who first introduces this brutality into Europe. Musical notation is developed into a scale of six notes by Gui d'Arete, monk of Arezzo. Ambrosian and Gregorian chants had existed since 390 and 600 A.D.

1022. **Arabs**—The Pisans and Genoese expel Musa and his Arabs from Sardinia ; this later occupation had lasted only about twenty-two years.

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1023. **Syria**—Tahirli Azazdin of Egypt ravages Palestine and plunders Jerusalem; the massacres of Christian residents and pilgrims become chronic after this date.

1025. **Arabs**—Hydropathy is known to the Moslems through Abu Sina of Bukhara, who lived in Syria and North Africa.

1026. **Spain**—Sancho the Great, king of Navarra and Aragon, recovers Castilla from the Moslems. Alphonso V. of Leon and Asturias ravages Moslem lands as far as Cordova and Visea.

1026. **Italy**—Burning alive now becomes a permanent Italian institution. *See* 1022. It is practised on the Paterini and Cathari at Milan and Monteforte by Archbishop Heribert.

1027. **Italy**—Coronation of the Emperor Konrad as king of Italy at Rome, in the presence of King Kanut, and of Rodolph of Burgundy.

1028. **England**—Kanut, with the help of the Wise men, promulgates a code of law; but the several customs of Northumbria, Mercia, and Wessex are also retained. The worship of fire, the sun, and of the old Odinic deities, is forbidden.

1028. **Byzantine Empire**—Institution of the Varangian Guard to maintain order and to protect the court during revolts. It consisted of Danes and Norwegians, as well as Russian Varangians.

1029. **Italy**—Settlement of some Neustrians at Aversa, helped by the Duke of Naples. These were chiefly the followers of Guillaume, son of Tancred of Hauteville, and his brothers, who were numerous.

1031. **Denmark**—Kanut recovers Sleswick from the Emperor Konrad the Salic; he also resubjugates Scotland, and receives homage from Malcolm, Maelbeth, and Jehmarc.

1031. **Spain**—Resignation of Hasham III., eighteenth and last Ummiad Khalif of Kordova. The Moors have now broken up the Arab power in Spain.

1031. **Byzantine Empire**—Recovery and rebuilding of Jerusalem by Romanus III. Argyrus.

1032. **Burgundy**—Rodolf III., last king, bequeaths the kingdom to the Emperor of Germany; apparently Dauphiné and Lyonnais become independent counties; Savoy is assigned to Humbert, Count of S. Maurizio; and the duchy of Burgundy had already separated. The rest, Transjuran Burgundy and Suabia, &c., is annexed to Germany in 1037.

1033. **Castilla**—Separation of Castilla as a new kingdom under Fernando I., second son of Sancho of Navarra.

1035. **England**—Death of Kanut, 11 Nov., 1035. Magnus, son of Olav II., seizes Norway, but admits Harold Hardrada as colleague. Harthakanut, the heir, remains in Denmark during the usurpation of Harold I. in England, 1035 to 1040.

1035. **Aragon**—Separation of Aragon as a new kingdom under Ramiro I., fourth son of Sancho of Navarra.

1035. **Byzantine Empire**—Year of severe famine throughout the Empire.

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1035. **Germany**—The Vends of Mecklenburg invade Saxony ; perhaps also the Vends of Pommern.

1037. **Arab Moslem**—Before this time, Abu Sina had introduced several newly-invented surgical instruments, among them a flexible catheter. He was the great authority on diet and hygiene, and in many branches of science.

1038. **Arab Moslem**—Death of the last Ummiad Khalif of Kordova. *See* 1031. Moslem Spain is divided into ten small kingdoms, Arab and Moorish.

1039. **England**—Under the oppressive rule of Harold, an executioner or headsman is first appointed, he is a reeve or sheriff.

1040. **England**—The Scots achieve some success in driving back the Norwegians. *See* 1020. Reputed first adoption of wind-mills ; a presumed Bohemian or Hungarian invention.

1040. **Neustria**—Lanfranc founds a school at Avranches, and introduces the learning of Pavia and Bologna (chiefly Latin authors and language), under the patronage of some nobles of Goron in Le Maine. The revival of learning in Western Europe begins from this time, according to repute.

1040. **Italy**—Invention of the Caroccio, a large banner-car, by Archbishop Heribert ; it is drawn by oxen and serves as a rallying point in war. (It is analogous to the processional cars of the Hindus, which were very ancient.)

1042. **England**—Death of Harthakanut, last of the Skioldung dynasty. Magnus, king of Norway, is his heir under the compact of 1035, but only obtains Denmark, while Edward, the son of Ethelred, is crowned in England. He brings Frankish and Neustrian prelates and officials, and introduces the French language again. Roving bands of Danes are suppressed. Ordeal by fire is still retained.

1043. **Denmark**—The capital of the Jomsberg pirates is destroyed by Magnus, king of Denmark.

1043. **Byzantine Empire**—Greek fire is used in repelling the attack of Duke Jaroslav on the entrance of the Bosphoros with a large force in boats.

1044. **Denmark**—An invasion of Lettish pirates from the Baltic is defeated by Magnus.

1044. **England**—Edward banishes many Danish nobles, and relatives of the Anglo-Danish kings.

1044. **Italy**—Self-adjusting tidal water-mills for grinding corn now exist at Venice, according to Zanetti ; they work at ebb and flow, and perhaps are modifications of the old Roman stream-mills.

1045. **England**—A fleet is prepared at Sandwich to oppose any invasion by Magnus.

1045. **Hungary**—Outburst of Pagan feeling. Vatha heads a revolt directed against Christian priests and foreigners, chiefly German ; bishops and priests are persecuted, churches are pulled down, Christianity is uprooted, and Shamanism is restored. Pietro, who ruled as imperial vassal of the Emperor Henry III., is deposed

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and blinded. A second similar rebellion occurred in 1062, under James, son of Vatha.

1046. **Italy**—Three usurping Popes are deposed by the Council of Sutrium, under the auspices of the Emperor Henry III.; and Clement I. is appointed.

1047. **England**—The exiled Anglo-Danish nobles, Asgod, Clapa, and Swen, sack Sandwich, and take the booty to Flanders.

1048. **Italy**—Italians from Amalfi found the first Christian hospital at Jerusalem; there had been hospitals at Lucca in 900.

1049. **Anjou**—The opposition to the dogma of transubstantiation, before expressed by Rhabanus, Ratramnus, and Erigena, is now headed by Berenger of Angers, and the movement extends greatly. *See* 1000.

1050. **England**—English wool is considered the best in Europe by the Germans and the Flemings; the best Flemish scarlet cloth is made of it; but the scarlet dye, sharal, is Oriental, though perhaps altered in name by the Venetians. Enfranchisement of the Cinque Ports. Assignment of lands and offices to Neustrians, who oppress the people and build castles for their own personal protection.

1051. **England**—Visit of William to King Edward, his cousin. Abolition of the heregeld and dismantling of the navy, to help William to acquire the succession.

1052. **England**—The privilege of holding a court of hustings under the town bailiff, or reeve, is granted to London and other towns.

1053. **South Italy**—Battle of Civitella. The Guiscards become independent dukes of Apulia.

1055. **Italy**—Rise of the independence of the Duchy of Lucca.

1056. **England**—A large embassy is sent to Constantinople to the Eastern Patriarch.

1056. **Bohemia**—All Germans are banished by Duke Spitignew II. This duchy had become tributary in 1039.

1058. **England**—The ceremony of touching for the King's Evil now exists; it is supposed that the cure was effected by the preparatory washing and the exercise of the journey.

1059. **England**—Several nobles visit Rome to obtain Papal intervention about bishoprics, and are robbed of everything, under Papal license to the robbers. They declare they will cause Peter's pence to be stopped if Nicholas II. does not restore all.

1061. **Bohemia**—Vratislas annexes Silesia, Lusatia, Moravia, and part of Pohlen during 1061-63, thus forming the kingdom of Bohemia; but it is still vassal to Germany.

1062. **Europe**—Pilgrimage of 70 000 European Christians to Syria; all are killed or enslaved.

1062. **England**—Beginning of a revival of learning. Harold's College, Waltham, is founded to introduce Suabians and Lorrainers as teachers. A minster was attached.

1064. **Denmark**—End of the sixteen years of war against Norway; Harald Hadrada wins the battle of Nissa and makes peace.

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1064. **Neustria**—William the Bastard seizes and imprisons Harald, the son of Godwin, who is cast on the coast of Penthiou by storm ; he also extorts a promise from him to admit his succession to the throne of England. William annexes Le Maine.

1065. **Denmark**—The Vendish pirates ravage Holstein, and burn Sleswick and Hamburg.

1065. **England**—Issue of the Code of Edward, the son of Ethelred, of British Anglo-Saxon and Anglo-Danish laws.

1066. **England**—Year of the three claimants : the rightful heir, Harald Hardrada ; the usurper, Harald, the son of Godwin ; and William, the cousin of Edward, and nominated heir. Gambling with dice is very prevalent in England.

1068. **Denmark**—Swen Estitson sends some help to the Anglo-Danes ; but the fleet was lost at sea.

1068. **England**—Curfew is established to lessen danger from conflagration ; it gives opportunity to inquisitorial officialism and intrusion, and is hence detested.

1068. **Spain**—Barcelona becomes a port of commercial resort.

1069. **England**—The King breaks his oath, and gives the country to pillage and confiscation by his Neustrian followers ; and orders massacres wherever an excuse offers.

1070. **England**—Lanfranc introduces better Latin orthography, and other knowledge, as before at Avranches. Norman feudal tenure is introduced. Devastation of part of Northumbria ; the fugitives settle in Cumberland, Cheshire, and parts of Scotland.

1071. **Italy**—A civil war results from the Papal attempt to enforce celibacy of the clergy through Cardinal Hildebrand.

1071. **Spain**—Death of 'Umar of Seville, physician and astronomer of high repute.

1072. **England**—Lanfranc establishes a hospital at Canterbury for sick persons.

1072. **Italy**—Roger Guiscard takes Greek towns in Sicily, and attacks the Sicilian Saracens.

1073. **Aquitaine**—Pope Gregory offers the crown of the West Franks to Duke Guillaume VI., while Philippe I. is reigning.

1073. **Italy**—A Pope is elected without imperial sanction. Disputes about investiture begin to be serious.

1074. **Denmark**—An expedition to England is bribed to depart by William.

1074. **Moors**—Yusuf, emperor of Morocco, enters Spain, subdues and annexes the small Arab kingdoms, and establishes the Moorish power in Moslem Spain by 1090.

1074. **Byzantine Empire**—The whole of Asia Minor is conquered by the Saljuki, from the Hellespont to the Euphrates.

1075. **Europe**—Promulgation of a Papal decree forbidding all ecclesiastical investiture by kings and rulers, at Rome, 24 Feb., by Pope Gregory VII.

1076. **Europe**—The Pope releases all subjects of the Emperor from their allegiance, in order to profit from the resulting rebellion.

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Anselm of Aosta endeavours to restrain the English clergy from marrying.

1077. **Germany**—Public degradation of the Emperor at Canossa, and submission to the Pope. Papal indulgences are now granted by decree of Pope Gregory VII.

1078. **England**—The hospice and almshouse of S. Bartholomew at Guildford is now established. *See* 1072.

1079. **Europe**—Papal interdict on Pohlen.

1079. **England**—Clearances for the New Forest are made in Hampshire. Immigration of Jews, who cause much ruin. Probably there had hitherto been some in Cornwall.

1080. **Denmark**—Kanut IV., the Saint, subdues Livonia.

1080. **Europe**—The Pope sells certain rights in Corsica to Genoa; after assigning rights to Pisa in 1077; a war for two centuries and the ruin of Pisa is the eventual result.

1080. **England**—A cadastral survey, with accounts of farm stock for six years, are made in the period 1080 to 1084. The taxation is rearranged accordingly.

1081. **Byzantine Empire**—Robert Guiscard attacks Durazzo, but incurs heavy loss by plague, storm and Greek fire; he takes it in Feb. 1082, and enters Albania and Thessaly.

1085. **Spain**—Temporary conquest of Toledo and Valencia by the Castilian troops of Alfonso I. and the Cid.

1086. **Denmark**—Revolt against Church tithes and murder of Kanut IV. for enforcing them.

1087. **England**—A stone bridge is begun at Bow of small dimensions; apparently it was needless, as plenty of timber was available; it is finished in 1118.

1087. **Italy**—Constantine Afer, a Carthaginian monk (d. 1087) who lived at Salerno, made the preparation of drugs a special art.

1089. **Norway**—Sæmund Sigfussen, a learned man of noble descent, who had become a priest, compiled the Poetical Edda about this time, from old oral and written account in Iceland.

1090. **England**—The liturgy of Salisbury, partly due to Lanfranc and the Anglo-Norman bishops, is now first used. The old Romish liturgy was that of York.

1090. **Hungary**—Conquest of Dalmatia. Long war against the Venetians, who occupy Illyria.

1090. **Italy**—The conquest of Sicily by the Guiscards is now complete. Syracuse was taken in 1088, but some Saracenic opposition continued till this time.

1090. **Byzantine Empire**—The first orphanage is instituted at Constantinople; one had existed at Milan in 787, and the ancient Romans had several.

1094. **England**—Massacre of some English inhabitants of South Wales.

1094. **Spain**—Alfonso I., king of Castilla and Leon, rewards Henry of Burgundy with the county of Portugal. This was the origin of the kingdom of Portugal.

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1095. **Denmark**—The land recovers through an abundant harvest, after being partly depopulated by starvation.

1095. **Europe**—The Emperor Alexius requests help against the Turks and Saracens from the Councils of Placentia and Clermont. Simon, Patriarch of Jerusalem, implores the help of Europe. Peter the Hermit preaches a crusade, and recommends the European colonisation of Palestine.

1095. **Bohemia**—Death of the first king, Vratislas; civil war and dissension begins now and lasts with intervals for a century.

1096. **Denmark**—Eirik subdues the Jomsbeig pirates, and builds forts for garrisons in their land.

1096. **Norway**—Magnus Barfod recovers the Hebrides and the Orkneys, and invades Scotland, probably claiming the northern counties; he makes terms and withdraws in 1099.

1096. **Europe**—Preliminary crusade of Peter and Walter with about 300 000 persons; they plunder Bulgaria on the way, and are destroyed near Nikæa by Kilij Arslan. Another crusading horde was massacred by the Hungarians on their entry into Hungary.

1096. **Germany**—Suppression of the Jews; many are killed.

1096. **Spain**—The Moslems are driven south of the Ebro, after the battle of Alkoraza, won by Pedro I. of Aragon.

1097. **Pohlen**—Vladislas Hermann recovers Prussia and Pommern, which had revolted in 1092.

1097. **Europe**—The First Crusade arrives at Constantinople, 15 May. Nikæa taken 20 June. Battle of Dorylæum, 4 July, 1097. Antioch taken, 3 June, 1098. Defeat of Kerboga, 28 June. Proposals to the Egyptians. March by Cæsarea to Jerusalem in 1099. Jerusalem is taken on 15 July. Battle of Ascalon, 12 August. Princedoms are established at Edessa, Antioch, and Jerusalem by 1099, under Baldwin, Bohemond, Guiscard, and Godfrey.

1097. **Flanders**—Godfrey of Bouillon uses the beffroi, or belfray, at the siege of Nikæa; some such siege-towers were used by Hrolfr in Frankland in 890.

1097. **Italy**—The Pisans conquer Corsica and recover Sardinia and the Balearic Islands; they also form some Levantine colonies or trade posts.

1099. **Byzantine Empire**—Recovery of all the Asiatic provinces through Crusading help.

DISCOVERY IN SPECIAL BRANCHES.

Chemical Separations and Discovery.

Perhaps some chemical processes of the Orientals were introduced in Italy by Constantine Afer.

Exploration and Settlement.

1000. Labrador or Helluland is sighted by Leif Eriksen on his voyage (see 986).

1000. Newfoundland or Markland is also sighted by him. He visits Kiel Armes, or Kiel Cape, afterwards Cape Cod.

1000. New England or Northern Virginia, termed Vynland, is rediscovered by Leif, son of Jarl Eirik the Red (see 983). His companions cut timber, gather grapes, and return to Iceland.

1007-8. Second settlement at Leifsbudhir, or at Haup Bay (Promontory Bay), of 160 persons, from Eiriksfiord.

1010. Visit of Thorfinn, Snorri and Thorhall from Iceland to Vynland (a settlement is afterwards made).

1014. The Almugavarez migrate from Lisbon to seek new lands beyond the Atlantic.

1027. Bjorn, an Icelandic Norwegian, is found in lands beyond Vynland.

1051. An Icelandic woman is killed in Vynland by some Skraelings, and is buried there (exhumed in 1187).

Voyages.

1087. Travels of Constantine Afer of Carthage, in Africa and in Asia; a physician who died at Monte Cassino.

11th century. Travels of Solomon Jarchi or Rashi, Jew of Troyes (b. 1040, d. 1105), in Egypt, Syria, and Persia.

TWELFTH CENTURY.

1100 TO 1199.

PERIOD OF THE EARLY CRUSADES.

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TWELFTH CENTURY

1100 TO 1199.

PERIOD OF THE EARLY CRUSADES.

GENERAL DEVELOPMENT.

THE record of progress for this century shows a very marked improvement on that for the preceding one. Something more than simple expansion of havings and belongings was the result. Sciences, hitherto buried in other languages, or confined to the use of Moslems, now became studied by a few Christians, from whom they afterwards spread further. The geometry of Euclid was the basis of the mathematics now newly known as a science. The original Greek text of Euclid's books had long been lost, and the Arabic translations were employed by Gregory Magisdros in Constantinople in 1040, c. ; perhaps also by M. Psellus in his compendium before 1079, and by Athelard of Bath in 1130. Gherardo of Cremona, who studied under the Spanish Moors at Toledo, doubtless used the Arabic text for his Latin translation of a work on geometry before 1187.

Giovanni Campano, of Novara, made an enlarged translation in this century.

Cosmography was introduced in Sicily through Idrisi; the survey, for which observations were taken during fifteen years, of distance, latitude, and longitude in Africa, and other parts of the world, was the first thing of that sort under Christian auspices. Roger of Sicily was the patron and introducer. In England the Boldoro Buke, or survey of the Durham episcopate, in 1183, was chiefly cadastral, though partly topographical.

Astronomy among the Christians existed in the translation of M. Psellus, and of Gherardo of Cremona. Northern

nations, specially the Danes, Anglo-Danes, and Norwegians, always had some small practical knowledge of this science; they had runic calendars, or lunar tables, primstocks and rune-stocks. The boldness of their navigators had been partly due to such knowledge.

Natural history was treated by the earliest of the English scientists, Alexander Neckam, who also wrote on other scientific subjects; his works contain germs of many branches of science, even remarks on vegetable physiology, colouring structure, &c. Botany, and a higher knowledge of plants and herbs, was however still nearly confined to the Moslem. In fact local herbs were plentiful, and were made to answer every purpose; the garden of herbs, attached to one of edible vegetables, was the basis of a local botany.

Chemistry and distillation, perhaps the elementary operations only, were introduced through the Spanish Moors. History was now studied; in England there was a historical library with numerous transcribers; also illuminators of books now improved their doings very greatly. Gunpowder, stone mortars, culverins and stone shot were introduced by the Moors in this century; but if the mariner's compass was actually known by Europeans it must have been used very little. Surgery was probably a new science, a novelty the monks were forbidden to practise in 1139. But in therapeutics and medicine, John Actuarius, a Greek convert, rose an important step beyond the medicine of Constantine Afer, of Psellus, and of the author of the English book on Leechdom; he wrote on the animal spirits. Athelard of Bath was a physician, but his works are probably not extant. Gherardo of Cremona translated Arabic works on medicine.

There are details showing that substantial comfort was also progressing in England; the improvement of house-building, the use of window-glass, chimneys and tiled roofs, were proofs of it; also the improved broad cloth and other weaving, the scarlet dye, better windmills, and the cultivation of hemp, all bore on the general well-being.

Though the commerce of European nations with each other and with Asia was yet in its infancy, the efforts in that direction are shown by the formation of the league of German ports for the protection of their trade, the early beginning of insuring cargoes and ships, of the use of bills of exchange and the knowledge of the funding system to the Venetians. Some plants were introduced into Europe from the Levant by

Crusaders and others; but it is very difficult to guess at those in England, for though there was a period of revived gardening, 1154-1185, it is most likely that none of the plants thus introduced survived with their accompanying necessary history. Probably they were chiefly medicinal herbs from Cyprus, Sicily, and Syria.

Though leprosy had invaded Europe, the wants of the sick were cared for not only at monasteries and abbeys, but at open hospitals under the care of medical monks, as the attached list for England shows; while separate special leper asylums also existed.

London—Clerkenwell Hospital of Knights of St. John	1100
Cirencester—Hospital of Knights of St. John	1100
Westminster—St. James's Hospital for Lepers (Giselbert)	1100
London—St. Bartholomew's Hospital (Raher)	1102
St. Alban's—St. Mary's Infirmary (Gorham)	1119-46
St. Alban's Road—St. Julian Leper Hospital (Gorham)	1119-46
Winchester—St. Cross Hospital (Henry)	1132
Northampton—Hospital of Knights of St. John	1138
Ripon—St. Mary's Hospital (Thurstan)	1144
London—St. Katherine's Hospital (Matilda)	1145
Bath—Hospital of St. John	1180
Durham—Sherburn Leper Hospital (Pudsey)	1180
Durham—St. Opportune Hospital, monks of St. Katherine	1188
London—St. Thomas's Hospital, London Bridge	c. 1180

If education was yet of a very primitive sort, consisting of imparting sufficient knowledge of Latin to be able to read it fairly, there were yet some colleges founded in this century; those of Dunstable, Cambridge, and Thornton in Lincolnshire, and the universities of Bologna, Paris, Padua, and Montpellier. The reliquary of the Abbey of St. Albans was actually a

museum, as it contained many and valuable curiosities, besides bones of saints and ecclesiastical relics.

The study of law now unfortunately came into vogue to the detriment of science. The Moslems had always based their law on the Koran, and on precedent. Every European country had its own local laws, even Iceland in 1117. But ecclesiastical or canon law based on decretals of Popes and Council began with Graziano of Chiusa in 1151, and spread through Europe. Ancient Roman law, based on the Code of Justinian, newly found at Amalfi, 1137 c., but adopted in Constantinople under Basil I. in 874 c., was taught in Italy by Guarnerio in 1110-20, and at Oxford by Vacarino.

The confusion of three systems led to the need for attorneys to pilot the way through legal intricacies. A comprehensible local Code of Law, with a set of paid officials to expound its bearings, was an institution then impossible and impracticable. The squabbles of law began in this century, and the lawyers have always since then shrouded law from the public.

Construction and building developed largely on the old lines. Many towns were built, and many large churches. In England the number of castles, abbeys and priories built in this century is surprising. Among public works, the Canal from Sluys to Bruges, and the Foss Dyke, an irrigating canal from the Ticino, and some irrigation near St. Albans, besides some drainage works in Flanders, form nearly the total. Mechanical construction was employed in making windmills, watermills and looms, as well as plate and chain armour, for gunpowder had not yet come into general use.

The Fine Arts, apparently, were in a lower state than before, or at least made no progress. There was no one corresponding to Gui, Franco, and Psellus of the last century. But Osmond, the Neustrian Dane who had arranged the Salisbury liturgy, doubtless with music, had his successor in Adam of S. Victor Paris, a hymnologist and composer of sacred music. The troubadours of this century, who were both poets and musical composers, were Guillaume Agout and Guillaume Adhémar of Provence, d. 1190; Ciulio of Alcamo, Italian, fl. 1190; Alberto Malaspina, fl. 1190, Italian; Howell ap Owen Gwynedd, Welsh bard, d. 1125; Prince Owen Civielog, Welsh bard, d. 1197. Johannes Tzebes of Constantinople, 1120-85, wrote poetry and possibly composed music with it; Robert Wace of Jersey, d. 1184, the panegyric romance-writer, and inventor of a Norman conquest, wrote verses, and may have written lyric music.

Painting and sculpture were in the same state as in the last century. But the names of three Early Italian sculptors of this century survive; they are, Buono of Venice, fl. 1154; Ventura of Bologna and Niccolo of Pisa, both fl. 1197 to 1220.

Leading Moslem Scientists of the Twelfth Century.

Abdul Malik ibn Zuhr, the elder, of Sevilla (see eleventh century) 1069 to 1161
 Abdul Malik ibn Zuhr, the younger, of Sevilla, carried on his father's practice, &c., and wrote on eye disease 1103 to 1179
 Abu Abdalla, Alkaiisi—scientist, writer about the Great Pyramid fl. 1170
 Abu Abdalla Muhammad Idrisi, *b.* Ceuta, 1099—cosmographer, surveyor, globe-maker fl. 1153
 Abu Ali Mahandis—scientist, writer on geometry. . . fl. 1136
 Abennefil—physician, writer on diet and medicine 12th centy.
 Abul Walid Muhammad Ibn Rashid (Averroesh), *b.* Cordova—physician, mathematician, &c. . . . d. 1199

Anwāri, Ashaduddin—astronomer and poet. . . . d. 1200
 Abu Muhammad, *b.* Andalusia—scientist d. 1194
 Afzaluddin Ibrahim, Khakāni—cosmographer of Irak 'Ajami and Irak 'Arabi d. 1186
 Arzaki, Hakīm—physician and historian d. 1189
 Fakhruddin Muhammad Razi, Imām—geometer and scientist 1150 to 1210
 Humenus, lived in Egypt—astronomer fl. 1148
 Iarchi, or Rashi Isaaki Sulaiman—astronomer and physician 1104 to 1180
 Ibn Hanbal—Arab physician and author d. 1213
 Nashwān bin Sayad Himīzi of Yemen—Arab scientist and author d. 1177
 'Umar Khayām, *b.* Naishapur—astronomer d. 1123

Leading Christian Scientists.

John Actuarius—writer on therapeutics . . . fl. 12th centy.
 Alan of Lille—physicist and philosopher d. 1202
 Athelard of Bath—physician and geometer fl. 1130
 Giovanni Campano of Novara—geometer fl. 12th centy.

Gherardo of Cremona—translator of Arabic science 1114 to 1187
 Alexander Neckam (Hertfordshire?)—naturalist and physicist fl. 12th centy.

POLITICAL CONDITION.

The condition of Europe relative to Asiatic intruders and external conditions was generally very favourable to progress. The balance between Europe and Asia that had been formed at the First Crusade was tolerably well maintained throughout the century till the Third Crusade; it was, from a crusading view, a century of success. There were no fresh invaders, unless some reinforcements of Moors in Spain be considered such, and the losses that the Christian kings suffered at the end of this century were partly due to their own disunion, while their former acquisitions had been made at a period of Moslem weakness and discord; thus relatively, even in Spain, the balance was not thrown out very much.

As to Syria itself, the Christian princedoms were stronger in 1192 than in 1099, and included more land. In the interval there had been some Christian encroachments, attacks on Ascalon, Jaffa, Accho, Tripoli, Sidon, and Tyre. How far these were needful for the protection of Christian pilgrims to Jerusalem, or were mere reprisals for the Turkish successes in 1101 over Guillaume VII., cannot now be determined. The land route from Constantinople to Jerusalem was hardly defensible under any circumstances. In the period of reverses, 1127 to 1151, nearly all was lost, but Jerusalem and Antioch, Damascus, Accho, and Halab. Ascalon was lost and recovered. The invasion of Egypt in 1168 by Almeric was fruitless, and in 1187 Salahuddin took all the Christian possessions. The Third Crusade of Richard and Philippe II. recovered everything. Yet it was evident that permanent possession could not be maintained in opposition to hosts from Asia and Africa, with the treachery and opposition of the Greeks to make things worse.

The African successes of Roger II. in 1144 were not only brilliant, but productive of effect on the Moslem mind. They were the first attacks made by Christian Europe in that quarter, and were unsurpassed for several centuries. His raid on Malta, Tripoli, Mahadia, Tunis, Sfax, Capsia, and Bona, was not so

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transient as some historians have supposed, for Mahadia was not recovered till 1156 by the Moors under Abdulmumen, the Almuwahad of Spain and Marrākash, who brought guns to bear on it. The Sicilians and Apulians had at least proved themselves superior to the Byzantine Greeks in war against the Moslem. Europe now seemed first capable of holding its own within its borders, if not beyond. The attacks on Alexandria and other African towns of William II. of Sicily, 1168-86, were less effective.

The wars of Europeans nations on each other, and their civil wars, were the disturbing causes. Denmark was fully occupied throughout the century in suppressing the Pagan Vends of Pommern, Mecklenburg, and the Baltic coasts, and acquiring an ascendancy there as far as and including Livonia; it was a legitimate aim, for Pohlen was very backward in all such attempts, and the loss of an army in Prussia showed how ineffective she was. The revolt of Lombard cities against the Empire, and other petty outbreaks, kept Italy in a state of civil war. In this century Arnold overthrew the Papacy for a short time as a political institution, replacing it by a Senate. This was an error that threw back the cause of Reformation for two centuries; religious and political matters should have been kept separate; the result was that Popes became as intolerant and grasping as before, perhaps worse. There were also the war between Venice and Padua, 1110 to 1143; the Milanese wars against the Emperor in 1162, and from 1177 to 1183; the two Pisan wars against Genoa in 1162-63, and 1165-75; the disputes for the Papal succession from 1130 to 1144; the Imperial attacks on Apulia and Calabria in 1129-30 and in 1153-54, due to the Sicilian kings joining the Papal or Guelphic party; and the third attack in 1193-94 which ended in annexation. There were also attacks by Venice and by Sicily on the Byzantine Empire and territories.

The German Empire was harassed by the Italian matters; but in Germany itself the Guelphic faction was worse after 1140, for the Franconian Emperors generally had opponents either in Bavaria or in Saxony, which included Thuringia and Hesse, though Westphalia had been separated from it. Hungary had thrown off allegiance to the Empire in 1108, and Burgundy, bequeathed in 1032, lapsed into fiefs in 1033 and 1125. Of these, part of Suabia and Transjuran Burgundy (Swiss) alone had remained German territory in 1033, besides Upper Provence, which went to the Count of Toulouse in

1125, and Lower Provence to the Count of Barcelona also in 1125. Of the rest, Dauphiné with Lyonnais became a new independent country; Savoy became independent under its own Counts; and the Duchy of Burgundy had a separate Capet dynasty; these three, lost in 1033, were never recovered. The two lost in 1125 also never again became German. The German Empire was hence exceedingly weak during this century. The Popes, who were anxious to fend off Asiatic attacks, had paralysed the leading power in Europe.

Bohemia, Pohlen, and the divided Russian duchies were weak; Christian Spain suffered from subdivision, and the kingdom of the West Franks was very small till the latter part of the century. The strong countries were Denmark, England, the Flemish duchies collectively, and Hungary. The long Danish wars against the Vends in East and West Pommern, Mecklenburg, and against the Letts of Livonia, throughout the century showed much force; the English kings had become rulers of large territories, partly by inheritance, Normandy, Le Maine, Anjou, Aquitaine, Gasconne, and Guienne, also part of Ireland in fact, though nominally the whole. The Flemish duchies were prosperous and peaceful with a large population. Hungary had thrown off allegiance to the Empire in 1108, and was temporarily profiting from the weakness of surrounding nations. It annexed Croatia and Dalmatia in 1100, defeated the Austrians in 1120, and in 1135 took Pressburg, and in 1181 Zara from them. It defeated the Bohemians in 1122, and acquired Zips from the Polacks in 1152. It annexed Serbia in 1138 and Slavonia in 1165, Byzantine provinces. It defeated the Muscovites in 1150, and in 1185 c. made good its hold on Red Russia (Volhynia and Podolia), which were Hungarian in 1028, but had been partly conquered by the Polacks in 1077. This was politically the only very prosperous period of Hungarian history; it evidently could not last long after this century.

The decay of the Byzantine Empire was a feature of this century. It achieved only three small temporary successes. A re-conquest of Armenia in 1137, which was overthrown in 1146; a re-conquest of Apulia and Calabria in 1153, overthrown by Roger II. before 1156; and the recovery of the Morea, Corfu, &c., in 1149. The betrayal of the Second Crusade of Louis and Konrad by Manuel in 1145-48 rendered the Comneni detested by Europe. William II. of Sicily removed that dynasty in 1185; but the Angelos Emperors were not

better. When Bulgaria had been lost to them in 1186, and Syria had been conquered by Sahāhuddīn in 1187, they continued the opposition to the Crusaders. In 1190 the exasperated Frederic stormed Hadrianople, Richard took Cyprus in 1191, and the Bulgarians sacked Varna in 1193. The Empire had neither allies nor territory; hence Constantinople was twice taken by the Crusaders in 1203 and 1204; and a Latin principedom superseded the treacherous Greek Empire.

The rise of the kingdom of France occurred late in this century. The West Franks under Louis VI. le Gros, and Louis VII. le Jeune, 1108 to 1179, had shown more activity than their predecessors, but had done little. Philippe Auguste in 1182 reduced to submission the chiefs of territories that had been vassal to the Frankish kings before 1070 or 1060. He then acquired Amiens from Philip of Elsass, and much territory from Flanders by 1191. The kingdom of France was now a substantial fact, and its king was an unscrupulous aggressor; the stealthy seizure of part of Normandy in time of peace, and the killing of Richard during a truce were unprovoked crimes.

The suzerainty of the King of England over Ireland by the submission of all the Irish princes in 1170 was a novelty. Ireland had remained in a semi-savage stage of local warfare since 1014; the O'Connors, 1142-69, seldom ruling more than one province, though titular kings of all Ireland. Ireland was also a depot for traffic in English slaves. There was ample cause for interference and for conquest, without the gift of Dermot MacMurrough. The Papacy, naturally anxious to abolish such a scandalous condition, might well advise an English occupation; but as to giving the country away, it had no right to do so. The acquisition of Leinster, and slave-dealing Ulster, was alone justifiable, the rest was premature, and the error produced harm for centuries.

There were not any religious wars, except the short struggle of the Arnoldists at Rome; but several sects were persecuted; the Bogomiles at Constantinople in 1118, the Anti-Sacerdotalists in Flanders in 1125, the Culdees suppressed at Dunkeld in 1127 and at Bardsey in 1188; the Arnoldists suppressed at Rome in 1155 were persecuted in Piedmont and Southern France in 1160, at the same time as the Valdenses; but the latter were expelled from Aragon in 1194. The Albigensians were massacred in 1183. The union of the Milanese church in 1190 was forced and needless.

The Patriarchs of the Eastern Church had been quite as

intolerant as the Popes, if the various massacres of supposed heretics be justly attributed to them, and not to monarchs and others. The Greeks had begun in 845 with extirpating 100 000 Paulicians, though at the same time the court of Constantinople publicly travestied ecclesiastical ceremonies with derision. Besides, the Eighth General Council of Constantinople in 869 had opposed and set aside the results of the preceding seven General Councils. The Eastern Church was far more heretical than those it persecuted. In 950 and 970 it slaughtered 600 000 persons. Afterwards, the real heretics of the Bulgarian heresy were slaughtered and persecuted. A complete severance of the Greek and Latin Churches was decreed by Council in 1054, which indicates that both Churches had assented to the preceding butcheries; though the Easterns had executed them. After 1046 the nominal union of the Armenian Church was furthered by much persecution in Armenia by the Greek Church.

But if the Eastern Church was pre-eminent in butchery, it yet did not interfere with political institutions; the Popes of the Western Church began this about 1073 (*see* Eleventh Century). In the twelfth century this had become a permanent institution; it was a Papal persecution of monarchs and nations, as shown by the following list of acts:—the Papal opposition to the Emperor Henry V. and his excommunication in 1115; the gift of Ireland in 1154; the opposition to Roger II. of Sicily in 1127; the Papal support of the Lombard league against the Emperor Frederic I. in 1167, soon after the Italian acceptance at Roncaglia in 1158; the public excommunication of Frederic I. in 1169; the Papal support of Otto IV. of Brunswick in 1197 against the Emperor Philip, and the countenance to the murder of Philip in 1208; the Papal interdict on Pohlen in 1079; the Papal opposition to Henry I. of England in 1155; the Papal interdict on Scotland in 1181; the release of William I. from vassalage to Richard I. of England in 1190; the opposition of Pope and clergy to Swerro, king of Norway, in 1198; and the Papal interdict on Leon in 1195.

There had also been some acquisition of territory near Modena from the Countess Matilda in 1077, and perhaps some subsequent acquisitions from similar sources, for in 1135 Henry of Bavaria compelled the restitution of Tuscany, Spoleto, and part of Naples, to him, from the Pope, as the dowry of Matilda

This collection of doings neither proves a beneficent theocratic rule by the spiritual heads of the Western Church throughout the century, nor does it show that Europe benefited from them generally. The acquisition of territory by them as Dukes of Benevento and Exarchs of Ravenna would be legitimate without undue religious influence on the givers.

Anarchy and civil war took long periods. In Pohlen for 156 years after the year 1139; in Bohemia for 60 years, 1098-1158; in the Kingdom of the Swedes and Goths for 96 years, 1066-1162; in Hungary for several broken periods; in England a severe civil war from 1135 to 1147; in Christian Spain for several broken periods; Norway was seldom free from strife, after it had gained independence in 1064, until the usurpation of Swerro in 1186. This was a markedly anarchical century.

Famine and plague were frequent and severe. In England a third of the population was killed in five years by plague and famine in 1120. In France and in England there was famine for three years in 1193-95. The plague also affected the crusaders in 1101 in Asia Minor as well as famine and attacks of the Saljuki, though it is impossible to guess what proportion of the whole 160 000 deaths was due to any one of the three causes.

RECORD OF PROGRESS AND EVENTS.

1100 TO 1199.

PERIOD OF THE EARLY CRUSADES.

1100. **England**—Geoffrey de Gorham (afterwards Abbot) arranges or composes the play of S. Katherine, which is performed by his pupils at Dunstable College. He probably acquired some such knowledge at Avranches, Bec, or Caen, from Lanfranc, who had introduced it from Lombardy. The Roman "*sceni ludici*" had probably survived in Italy, or had been reintroduced from Constantinople. Rise of booksellers in cathedral towns; they sell missals and school-books, and let some books on hire. They employ scribes and copyists, who perhaps use wood-blocks. Heraldic insignia are now more used than before. Submergence of Godwin's land.

1100. **Wallachia**—Immigration of Bulgars and Thracians from the south of the Danube.

1101. **Europe**—A supplementary crusading force of 160 000 men from Bretagne, Aquitaine, and Bavaria, is destroyed in Anatolia by plague, famine, and the Turks; it was partly under Guillaume le Jeune VII. of Aquitaine.

1102. **Norway**—Magnus III. Barfod, allied with Murdoch, king of Connaught, subdues the kingdom of Dublin, and overruns Leinster and Munster; but in 1103 his Irish allies attack him and kill him on the coast of Ulster.

1103. **England**—The council of London forbids the export of English serfs to the Continent. Partial abolition of Curfew. Feudal service falls into disuse; taxes are raised arbitrarily.

1104. **Latin Princes**—Baldwin, king of Jerusalem, who had defeated the Moslems at the battle of Jaffa in 1102, besieges Accho twice, and takes it after a defeat. This is the beginning of a series of encroachments and annexations, that apparently were not originally contemplated.

1105. **Denmark**—War against Eirik, king of the Obotrites or Slavs of the Baltic between Mecklenburg and Pommern.

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1105. **England**—The Pope disputes the right of the King of England to nominate English bishops.

1105. **France**—Windmills are now well known ; they were probably introduced about 1040.

1107. **Norway**—Crusade of Sigurd I. with sixty ships for four years, to Portugal and Palestine ; he destroys two Moorish fleets and sacks Cintra and Lisbon.

1107. **Europe**—Papal Council at Troyes. The celibacy of the priesthood now becomes compulsory.

1107. **Italy**—Rise of the independence of Milan as a republic.

1108. **England**—Immigration of Flemings to South Wales, where they build Tenby ; and to Northumbria, whence they soon move to South Wales, in 1112.

1108. **Latin Princedoms**—Tripoli is taken and formed a county vassal to Jerusalem.

1109. **England**—The land-tax on land of all sorts is fixed at 3s. per hide of 60 acres.

1109. **Spain**—A violin with five strings, and a guitar with three strings, are now known ; the peacock is also known, at Silia near Burgos. *See MS., B. M. L., 11695.*

1110. **England**—A college is founded at Cambridge ; but it is supposed that some school existed there in 896 or in 915. The revival of learning had begun with the founding of Dunstable College in 1100, under Geoffrey for the king, and the Abbot of S. Albans.

1111. **Flanders**—Woollen cloth is now largely exported to England and other countries. *See 960.*

1111. **Latin Princedoms**—Baldwin I., with the help of Sigurd, takes Sidon ; but the Moslems recover it in 1115.

1112. **Hungary**—Koloman the learned, who had massacred the crusading emigrants in 1096, now stops all prosecutions for witchcraft, saying that witches do not exist.

1115. **Papedom**—The Emperor Henry V. opposes the Papal acquisition of territory by bequest, in the case of the Marquisate of Tuscany ; he is excommunicated by the Pope.

1117. **Iceland**—The first Code of Laws, Precedents and Poor-law is drawn up, termed the Gragas ; they are established by the next Althing of the republic.

1118. **Italy**—Disputes for the Papal chair begin at the death of Pope Pascal II.

1118. **Spain**—Gunpowder and guns are used at Zaragoza by the Moors. Alfonso I. of Aragon had besieged it for eight months before taking it on 18 June. It was a town of a petty Arab kingdom taken by the Christians, and remaining Christian since 1048 ; but had been seized in 1116 by the Moslems of Abu Hassun Ali. It is supposed that the second relief with the help of the guns was ineffective.

1119. **Latin Princedoms**—Baldwin defeats the Moslems at Antioch.

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1120. **England**—Severe pestilence in England for five years, which, with an accompanying famine, kills one-third of the population. Abbot Geoffrey sells the ornaments of the altar of S. Albans, and gives the money to the hungry. Geoffrey forms a large library of historical manuscripts by employing transcribers; he also forms a collection of antiquities and relics; the first English museum. A fleet is lost near Alderney.

1120. **France**—A clock (horologium) at the monastery of S. Victor at Paris is mentioned by Bernard the monk in the 'Ordo Cluniacensis.' Such clocks struck to awake a sleeper, and pointed the hour. But equal hours were not yet in vogue, hence the monk made an allowance and struck the estimated hour, or twelfth of the day or of the night. Such mechanism had been used in India and in China for ages, but there the *ghari* was a mechanical sixtieth of twenty-four hours, or twenty-four-minutes always.

1122. **Byzantine Empire**—The Petchenegans invade Thrace and are crushed by Emperor Johannes II.

1122. **Arabs and Moors**—Before this time Abul Kásim ul Sahrawi had used the probang and introduced several surgical appliances.

1122. **China**—Earliest proved date of the actual use of the mariner's compass by the Chinese; in the case of the Chinese embassy going from Nanking to the Corea.

1123. **England**—Re-introduction of parks, portions of forest thinned and improved for reserves of deer and cattle; the first is made at Woodstock.

1123. **Latin Princedoms**—The troops of Baldwin II. of Jerusalem, with the help of a Venetian fleet, take Tyre after 5½ months' siege, on 29 June. The Venetians under Dom Micheli defeat an Egyptian fleet near Jaffa.

1124. **Europe**—The adoption of seven sacraments instead of two is proposed by Otto, bishop of Bamberg; this institution is opposed in England. Priestly absolution is hence now a sacrament; it was meant to combine public absolution of sins openly confessed, and voluntary confession of private faults; two distinct things.

1125. **Latin Princedoms**—Baldwin defeats the Saracens near Antioch; but the Venetian fleet leaves, and plunders the Ionian Islands, then Byzantine possessions.

1126. **England**—The king sets aside the Constitution, and appoints his daughter heiress of the crown; an error that caused civil war.

1127. **Latin Princedoms**—Beginning of a series of reverses to the Christians in Syria. Zangi, governor of Halab, defeats the Christians, takes Mosul, and, in the following year, recovers from the Christians all their possessions beyond the Frat.

1127. **Italy**—End of the Milanese civil war about Como, which had lasted for ten years, and was due to two bishops being appointed to the same place by the Double Papacy.

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1130. **West Pommern**—Wratislas, who had accepted Christianity in 1124, invades and conquers the county of Brandenburg and Uckermark.

1130. **England**—Mathematics begins now as a recognised science, after the translation of Athelard, a monk of Bath, of the geometry of Euclid into Latin. Supposed date of a chimney in Rochester Castle. About this time the Pope sends his seal to be put on the top of S. Alban's Abbey to preserve it from lightning. It is ineffective, for the lightning strikes the abbey again.

1131. **Latin Princedoms**—Foulque of Anjou, king of Jerusalem, and Count Baldwin of Edessa are defeated by the Armenian troops of Leo I.

1132. **England**—A few Flemings settle at Norwich and use improved Flemish looms (Gervase).

1132. **Spain**—A culverin throwing a four-pound stone shot is made locally in Spain.

1133. **England**—King Henry rebuilds the castles of Normandy and Lemaing, as far as the tower of S. John, near Mount S. Michel; also in Coutances, for its defence.

1134. **Germany**—Secret tribunals are now established.

1134. **Italy**—Arnold of Brescia, an ecclesiastic, begins to condemn Papal wealth and ostentation, and to propose that the clergy should live by frank-almoign. This, the first Reformation attempted in Europe, develops into riot and seizure of Rome by the Arnoldists.

1136. **Denmark**—Eirik IV. Emund defeats the Vend pirates, and destroys Arcona.

1136. **England**—Some improvements in windmills are now made. *See* 1040.

1138. **Germany**—Diet of Wurzburg; redistribution of territory affecting Saxony and Bavaria.

1138. **Italy**—Revival of a knowledge of civil law (based on the Justinian code) by Guarnerio at Bologna.

1139. **England**—Reputed date of the introduction of the cultivation of hemp.

1139. **Pohlen**—Beginning of an anarchical period of divided territory, lasting 156 years.

1139. **Europe**—Tenth (or second) Lateran Council of 1000 fathers. Condemnation of Arnold of Brescia (*see* 1134), who is driven to Zurich.

1139. **Italy**—Pope Innocent II. forbids the practice of surgery by monks, and threatens such offenders. (The medical knights were the capable and recognised practitioners.)

1140. **England**—Beginning of a period of castle building; about 1000 castles were built in fourteen years. Improved arbalists and manubalists are employed. The canon law of Gratian, or Roman ecclesiastical law, is introduced nominally. A superior style of illuminating manuscripts becomes prevalent; it was introduced in 1120 in the scriptorium of S. Albans by Geoffrey de

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Gorham, and was brought by him from Lemaine (acquired at Tours or at Avranches).

1140. **Germany**—Union of some seaport towns for commercial protection; thus forming the foundation of the future Hanseatic league. Rise of the Guelphic faction under Guelph III.

1140. **West Franks**—Invention of the theory of the Seven Sacraments by Peter Lombard, bishop of Paris. *See* also 1124. Abélard, a French monk, is condemned. The Dominicans oppose the rising dogma of the Immaculate Conception, and declare it based merely on a woman's vision.

1143. **England**—First translation of the Koran into Latin, and better knowledge of the theoretic principles of Islam. Water-mills as well as windmills are well known (Dugdale, *Chr. of Pipewell Abbey*).

1144. **Denmark**—The Slavonic or Vendish pirates of the Baltic defeat King Ernk.

1144. **Netherlands**—Sweetened and unsweetened beer are known; the sweetening is given with honey; but there is no mention of hot ale as formerly in Denmark.

1144. **Germany**—Bishop of Freisingen introduces the peripatetic philosophy.

1144. **West Franks**—Louis VII. burns 1300 persons alive at Vitry sur Marne, merely out of personal revenge on Count Thibaut.

1144. **Italy**—Restoration of the Roman Senate by Arnold of Brescia. The Pope hides himself.

1144. **South Italy**—Roger of Sicily attacks Tunis, Tripoli, and the Berber coast with success.

1144. **Latin Princedoms**—Zangi, governor of Halab, seizes Edessa (Orfah).

1145. **Europe**—Second Crusade, preached by Bernard of Clairvaux. About a million men join it, under the Emperor Konrad and Louis VII.; it leaves Europe in 1147.

1146. **England**—Numbers of Routiers or Brabançons, Picards or Flemings, were employed as mercenary troops in the civil war. (William II. and Henry I. had used them)

1146. **Italy**—The art of rearing silkworms is introduced in Sicily by Roger II., from Constantinople. In this year Roger takes Corfu, Athens, Thebes, and Corinth.

1146. **Latin Princedoms**—Nuruddin defeats Jocelyn de Courtenai, annexes Damascus to Halab, and recovers great part of Syria.

1147. **Europe**—The Crusaders under Konrad pass through Hungary, and go towards Koniah and Ephesus; return to the coast, and go by sea. The French troops defeat the Moslems near the Meander, go by way of Philadelphia and Smyrna, but are defeated and return to Satalia, and thence to Antioch. One-tenth of the force, about 100 000 men, embark in Greek ships and go to Jerusalem; they attempt to take Damascus by siege in 1148. Edessa was not recovered, and this Crusade effected nothing. The Emperor Manuel behaved treacherously, by misleading the Cru-

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saders, and even attacking them. In 1149 Louis VII. was captured at sea by the Moslems, and rescued by Roger of Sicily

1148. **Sicily**—The cultivation of sugar exists in Sicily and in Cyprus ; but in Spain it had existed since 711 A.D.

1149. **England**—Roman law is taught at Oxford by Vicarino, a Lombard. (This is canon law, based on ordinances and decrees of popes and councils.)

1150. **Denmark**—The Vendish pirates defeat Adzer, and attack Jutland ; the Danes form brotherhoods to defend their coasts, and they take eighty-two Vendish ships.

1150. **England**—The Saxon chronicle is now first written in Semi-Saxon.

1150. **Spain**—A knowledge of chemistry and distillation is introduced by the Moors among the Spanish Moslems, and is afterwards acquired by Spanish Christians.

1151. **Hungary**—A Flemish immigration into Hungary, and a German immigration into Transsylvania, 1143 to 1151, take place about this time.

1152. **Sweden**—End of the long anarchy caused by the Pagan and Christian factions.

1153. **England**—Mining for silver is carried on in Cumberland. Eleven hundred castles were destroyed in this year of civil war in England. Somerled invades Scotland from the Hebrides. Acquisition of Aquitaine, Poitou, and Touraine as the dowry of Eleanor, wife of Prince Henry.

1154. **England**—Bordeaux wine is imported, and English wine is no longer made. Reform of the Liberties of S. Albans ; other abbeys are afterwards freed from oppression. Abbot Robert de Gorham obtains a Papal grant of Ireland to the English crown from Pope Hadrian ; also privileges for his own abbey. Hadrian refused gifts, but his curia scrambled for all they could get. A short revival of gardening, lasting thirty years, began about this time.

1154. **Germany**—Diet of Goslar ; re-distribution of territory in Bavaria, Saxony, and in Italy.

1154. **Italy**—Election of William Brakespear as Pope Adrian IV. ; he opposes Arnold and puts an interdict on Rome.

1155. **Italy**—Pope Adrian IV. suppresses the Roman Senate. Arnold of Brescia is burnt or hanged at Rome after his second capture in Tuscany, with the consent of the Emperor Frederic I. Barbarossa. He had virtually ruled Rome for ten years, and has once been rescued by the Viscounts of Campania.

1156. **England**—The seat of government is transferred to Westminster from Winchester, where it had been since the year 827.

1156. **Sicily**—The Tunisians or Moors under Abdulmumen use gunpowder and guns at the taking of Mahadia, and defeat of the Sicilians. *See also 1144, 1118, 1132.*

1156. **Muscovy**—Jurje, a Russian duke, builds Moscow. He

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had founded Vladimir in 1150. At this time, Novgorod and Smolensk were independent duchies.

1157. **Denmark**—Beginning of twelve years' war against the Vends of Pommern and the Baltic provinces.

1157. **Italy**—Establishment of the Public Bank of Venice

1157. **Latin Principedoms**—Baldwin defeats Nuruddin and annexes Ascalon.

1158. **Italy**—Diet of Roncaglia, about Imperial fiefs. Italy accepts Imperial sovereignty.

1158. **Bohemia**—End of sixty years' civil war; Duke Vladislav is crowned king.

1158. **Italy**—Introduction of local town government under a podestà instead of elective consuls; it is first adopted at Milan.

1159. **Popedom**—The Pope excommunicates the Emperor Frederic I.

1159. **Saxony**—Henry the Lion, duke of Saxony and Bavaria, subdues the Vends of Mecklenburg; he kills their chief, Niclot, and builds Schwerin.

1160. **Denmark**—Waldemar subdues the Vendish pirates, takes Rugen, and subjugates West Pommern under Vratisslav, and East Pommern under Subisslav the Old.

1160. **England**—Brutal persecution of thirty German heretics (Arnoldists or Halleans) by the clergy, who forbid them food and shelter; they die of cold and starvation in London as a result of advocating frank-almoign instead of tithes. Bills of Exchange are now mentioned.

1160. **Popedom**—Persecution of Arnoldists and of Waldenses in Piedmont and Southern France.

1160. **Italy**—Guelf, heir of the Marquisate of Tuscany, sells his territory to the Emperor Frederic; eventually Florence, Siena, and Pistoia, become independent. The Guelf and Ghibelline factions begin war in Italy. *See* 1140.

1161. **England**—Public Papal humiliation of the king. Revival of clothmaking and other weaving at Nottingham.

1161. **Pohlen**—Entire destruction of a Polish army under Boleslav IV. in an attack on East Prussia.

1162. **Sweden**—End of ninety-six years of civil discord, Charles Swerkerson becomes sole monarch. *See* 1152.

1162. **England**—Somerville again invades Scotland from the Hebrides, and is killed.

1163. **Brandenburg**—Markgrave Albert founds Berlin.

1163. **Pohlen**—Invasion of Prussians, Pomeranians, and Bohemians; Silesia throws off allegiance.

1163. **France**—Council of Tours, 19 May. Condemnation of the Albigeois.

1163. **Latin Principedoms**—Nuruddin defeats Raymond, prince of Antioch, and sends his head to Baghdad.

1164. **Popedom**—Papal claim to the exemption of priests from secular jurisdiction.

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1164. **England**—The herring fishery is now begun on a larger scale; it had existed off Northumbria and East Caledonia in the ninth century. The constitutions of Clarendon recognising trial by jury are now promulgated.

1164. **Germany**—The commercial league of seaports increases in strength. There is war in the Palatinate against the bishops of Koln and of Worms.

1165. **Italy**—War is resumed between Genoa and Pisa; it lasts for ten years this time.

1166. **England**—A revolt in Le Maine is quelled by King Henry II. Expulsion of Dermot Macmurrough, king of Leinster, by Ruric O'Connor.

1168. **Latin Princedoms**—Almeric, sixth king of Jerusalem, invades Egypt without success.

1169. **Denmark**—Seventh expedition of Waldemar against the Vendish pirates; Rugen and Arcona are taken. The temple and image of Svantovit are destroyed, and the Vends accept Christianity.

1169. **Ireland**—Dermot Macmurrough having made terms for the recovery of his kingdom, he and Fitz-Stephen, with troops from England and Normandy, take Wexford and other towns, and occupy Leinster.

1169. **Europe**—Papal excommunication of the Emperor Frederic Barbarossa.

1171. **Denmark**—Publication of the codes of Waldemar I.

1171. **England**—Henry II. conquers and annexes Ireland with the consent of Dermot and the Pope; but Leinster alone is occupied permanently. Most of the Irish princes submit, and they agree to stop the traffic in English slaves. In 1172 the great synod of Cashel acknowledges the civil authority of the King of England, and the ecclesiastical superiority of the Anglican Church.

1171. **Italy**—The Venetians introduce the funding system.

1172. **Spain**—Civil war breaks out among the Christian kings of Navarra, Castilla and Aragon, and lasts for seven years.

1173. **Italy**—The dyers of scarlet in Italy and the Levant are chiefly Jews and Syrian Greeks.

1174. **Denmark**—Waldemar takes Jomsburg and makes the Vends tributary.

1176. **Denmark**—Waldemar destroys Jummeta or Julin, now Wollin, at the mouth of the Oder.

1176. **England**—Redistribution of land in Ireland and Treaty of Final Concord. Appointment of judges to go on circuit.

1176. **Italy**—The Leaguers defeat the Imperial troops at battle of Legnano, 29 May. The cities of Lombardy become independent. Imperial concessions are granted to some towns; mediation is effected between Genoa and Pisa; Sardinia is ceded to Genoa and peace is made.

1177. **England**—A historiographer is appointed at the Abbey

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of S. Albans, and a compendium of history is compiled from the records, which is finished in 1200.

1177. **Latin Princedoms**—Baldwin IV. defeats Sultan Salahuddin near Jerusalem.

1178. **Europe**—A Papal embassy is sent to Prester John, but never arrives near him; it goes by misdirection to Abyssinia, whereas Malik Yuhanna was at Karakorum—in Little Tibet. (Second or Tenth Lateran Council.)

1179. **Spain**—Mediation of King Henry II. of England; he makes peace among the three kings of Navarra, Castilla, and Aragon.

1179. **Latin Princedoms**—Sultan Salahuddin defeats the Christian troops.

1180. **Denmark**—The Imperial claims to homage from Denmark for the Vendish conquests, which were admitted in 1162, are now waived.

1180. **England**—Reputed date of the early use of window glass in private houses; it had long been used in churches; there was in 674 a glass window in Wearmouth Church, but it had been made by foreign workmen. Improved house-building begins.

1180. **Germany**—Diet of Wurzburg, redistribution of territory in Saxony, Bavaria, and the Palatinate; also of Austria and Westphalia, and Brunswick. Ratisbon, Augsburg, Passau, &c., are declared free towns.

1180. **West Franks**—Expulsion of all Jews from the country. There was a notion that Jews crucified a Christian child at their passovers, when they could; but this was an error. The last attack on Jews was in Germany in 1096, many were killed. It was believed that they acted as spies. Accession of Philippe II.

1181. **Papedom**—Exclusion of the clergy and the mob at a Papal election; Lucius III. is the first Pope chosen by the cardinals alone. Interdict on Scotland.

1182. **Latin Princedoms**—Sultan Salahuddin achieves some success near Damascus. The Pope (Ubaldo Allocingoli) Lucius III. opens correspondence with him.

1183. **England**—Pudsey completes the Boldon Buke survey of the Durham episcopate.

1183. **West Franks**—Massacre of 7000 Albigeois by the people of Berri under priestly advice. *See* 1163.

1183. **Italy**—Peace of Constance with twenty-four Lombard cities; their independence is acknowledged by the Emperor Frederic I. Barbarossa. *See* 1176.

1184. **Denmark**—Knut VI. takes the title of King of the Vandals, after subduing Bogislas, duke of Pommern, and the two dukes of Mecklenburg.

1185. **England**—End of a reputed period of revived gardening (1150-85), in which perhaps some botanical introductions from the Levant were made. Rebellion of Prince Richard and alliance

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with Geoffrey ; they make war with Breton troops against the King of England.

1185. **Italy**—Pope Urban III. (Uberto Crivelli) equips a fleet for the Crusades.

1187. **England**—Arched foundations are first built at S. Paul's Church, London.

1187. **Italy**—Pope Gregory VIII. (Alberto di Morra) mediates between the Pisans and Genoese.

1188. **Europe**—Third Crusade, of men from Normandy, Frankland, Genoa, Pisa, Venice ; also from Germany under Emperor Frederic, and from England under Richard. The Danes and Hollanders chiefly force Salahuddin to retreat to Damascus. The siege of Ptolemais (Accho) thirty miles south of Tyre, begins in August 1189, by Philippe and Richard, and is taken 12 July, 1191. The Emperor Manuel thwarts the Crusade, hence Frederic takes Adrianople and Nikæa, and Richard takes Cyprus afterwards. The Emperor Frederic is drowned in Cilicia ; Richard takes Kaisaria and Jaffa ; he has a battle of eleven days' fighting and takes Ascalon. The treaty with Salahuddin is made in 1192. The coast from Jaffa to Tyre, Tripoli and Antioch, are to remain Christian territory, with free access of pilgrims to the Holy Sepulchre. Richard rebuilds Ascalon.

1189. **England**—MacCarthy of Desmond asks for English intervention in Ireland. Some copper mines are now worked ; and some improvements in cloth weaving are made, and English cloth is soon largely exported again. Edict ordering slated or tiled roofs, and lower stories of stone in London houses. Many extortionate Jews are killed by the mob in revenge for the ruin they caused.

1190. **Italy**—Union of the Ambrosian or Holy Milanese with the Romish church, after independence for 800 years. It had a separate hierarchy of priests, twenty-one elective bishops, a metropolitan, cardinals and provincial council ; but it acknowledged the Pope as head of the Church.

1191. **Germany**—Papal humiliation in public of the Emperor Henry VI. by Pope Celestine III.

1191. **England**—The national flag of Richard I. is still the "Dragon" of Wessex.

1191. **Germany**—Reconstitution of the Teutonic Orders of Knighthood.

1192. **Europe**—Fuller development of heraldry, resulting from the needs of the Crusade ; probable adoption of crests. The ancient Danes ornamented and coloured their shields and blazoned their swords and had Ægis-helms ; the Anglo-Saxons of the heptarchy had family bearings ; the Franks of the 9th century had some blazonry, and the Germans had tribal banners with devices. European heraldry dates from the time of Odin. *See* 953 and 1100.

1192. **England**—Leopold V., duke of Austria, seizes King

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Richard in December, and imprisons him. Philippe of France seizes Normandy in the absence of Richard.

1192. **France**—Philippe Auguste (acc. 1180) recovered some former vassal territories in 1182, acquired Amiens, Vermandois, and Valois in 1185, and annexed Artois in 1191; thus forming the new kingdom of France.

1193. **England**—Pestilence and severe famine in England for three years, 1193–95.

1194. **England**—Richard is ransomed for 190 000 marks, and goes to war against Philippe.

1194. **Aquitaine**—Insurance is mentioned in the Roole d'Oleron. (Bottomry was carried on by the ancient Greeks.)

1194. **Italy**—The Emperor Henry VI. takes Capua and Palermo from Tancred, and annexes Apulia and Sicily for his wife Constance. They are retained for sixty years.

1195. **Spain**—Papal interdict is placed on the kingdom of Leon, ruled by Alfonso IX.

1196. **Spanish Moors**—Almansur takes Calatrava, Guadalajara, Madrid, Salamanca, Albulat, Torjuelo, and attacks Toledo, achieving a series of victories.

1197. **Europe**—Supplementary crusade of Henry of Saxony, Count Palatine, and Henry of Brabant. Sidon is taken, but the crusade is abandoned at the death of the emperor.

1197. **England**—Good English broadcloth is now made and exported. *See* 1189.

1197. **Germany**—The Minnesingers are now a flourishing institution (Walter von Vogelweide).

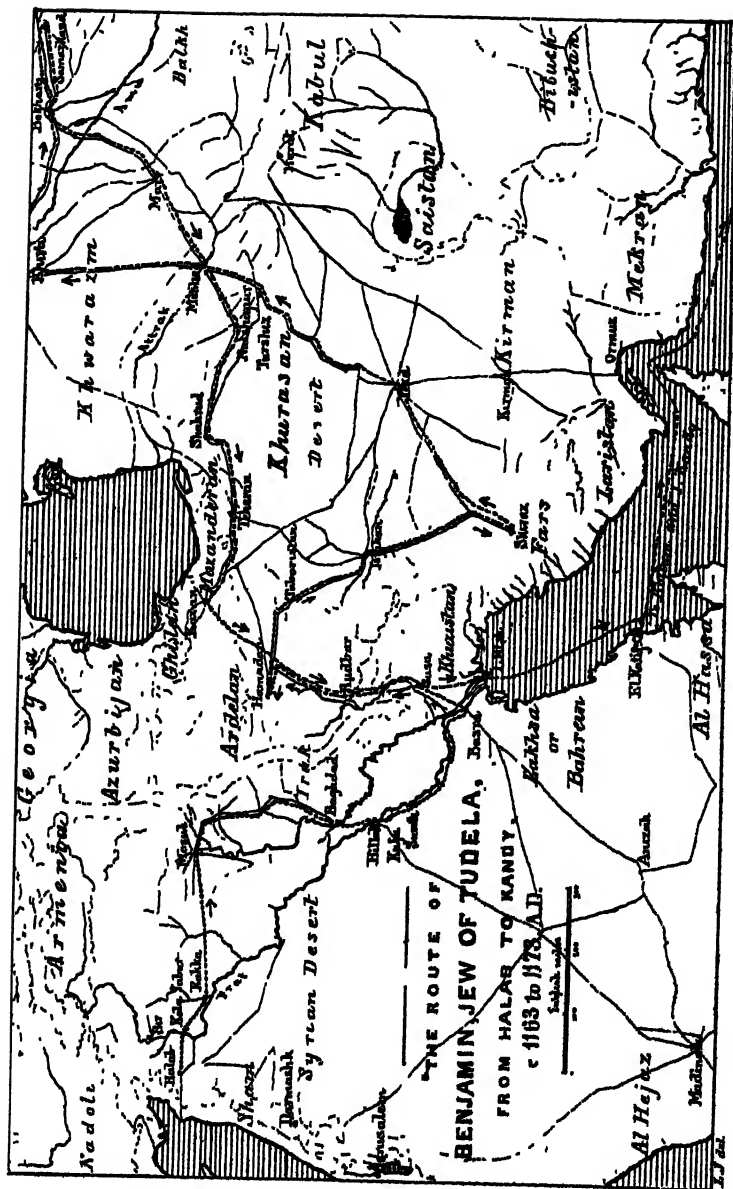
1198. **Denmark**—Resubjugation of Livonia by the king and the markgrave of Brandenburg.

1198. **Europe**—Election of Pope Innocent III. Third or eleventh Lateran council. Marriage now becomes a sacrament. Waldenses and heretics are forbidden to buy, sell, or trade.

1198. **Italy**—The independence of the republic of Florence dates from this year.

1199. **England**—King Richard is murdered during a truce near Chalus. A legal interest is now fixed at 10 per cent. for money lending.

1199. **Spain**—Benjamin of Tudela, a Spanish Jew, finds many hospitals, dispensaries, and madhouses at Baghdad (1163–73); similar institutions afterwards rise in Navarra.



DISCOVERY IN SPECIAL BRANCHES.

Archaic Discovery.

1137. The Pandects of Justinian, or Digest of ancient Roman law, are found at Amalfi. (The effect was to supersede Christian ethics by notions of law and expediency.)

Naturalistic Note.

1118. The beaver still exists in Wales and in Caledonia (*Giraldus Cambrensis*).

Chemical Separation, &c.

12th Century. Separation of Nitric acid, though by a secret process, by Theophilus. This was before known to the Moslems.

Exploration and Settlement.

1108. Flemish settlement in South Wales.

1120. Colonies of Netherlanders are formed in Lower Saxony and parts of Germany after this date.

1143 c. Flemish settlement in Hungary.

1143-51. German settlement in Transylvania.

1146. The Biabançons enter England.

1147 c., or later, English settlement at Villafranca de Xira, called Cornualla, near Lisbon.

America.

1121. Mission of Eirik Upai, bishop of Greenland, to the colony of Vynland. (This colony existed

till 1261, or perhaps till 1319, but record is wanting.)

Africa.

1188. Some Arabs explore Central Africa. The Arab geographer Abu Abdallah Muhammad el Idrisi, b. Sibta (Ceuta) 1099, writes a description of Africa for Roger II. of Sicily, c. 1153.

Asia.

1168-78. Asiatic Expedition of Benjamin, Jew of Tudela in Navarra, from Halab to Bales and Kala Jabar, to Rakka at the confluence of the Belich and Frat. Thence across to Charan, Nisibin, Jasirah, and Mosul. From Mosul to Rahaba, Karkisia, Juba, Charda, Okbera, and Baghdad. From Baghdad to Ras al Ain, Hillah, Kufa, Sura, Shafjatib, Al Yemen, Thannaim, Telmas, Khaibar, Wasith, and Basra. From Basra to Korna, Shūshan, Rudbar, Mulehet, Amaria, and Hamadān. From Hamadān to Tabaristan, and to Ispahān; also to Fārs (Shiraz). From Shirāz to Ghiva (Khiva, or perhaps another place), and to Samarkand. From Samarkand to Kazvin, thence into Khuzistan to I. Kish, and by sea to El Katif. From El Katif to Khullam (Kollam) and the I. Kandy. Thence back to Kollam and to Sabid (Abyssinian port) into Middle India (Nubia?), and to Assuān into Egypt, and to Europe.

THIRTEENTH CENTURY

1200 TO 1299.

PERIOD OF THE MUGHAL CONQUEST.

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THIRTEENTH CENTURY

1200 TO 1299.

PERIOD OF THE MUGHAL CONQUEST.

GENERAL DEVELOPMENT.

EUROPE made but very little progress in this century under the extremely difficult conditions which will be set forth in the *Section on Political Condition.*

The financial condition of every one, except the ecclesiastics and the Jews, must have been terrible from continuous poverty. Bohemia was the leading power of Central Europe in this century; it had stopped the Mughals, and, besides, profited from the difficulties of the suffering nations, Pohlen and Hungary; it then opposed Austria on a convenient occasion and proceeded to annex more. Certainly its supremacy was transient and not very lasting; but it will be noticed that after its wealth must have reached its climax the Jews of Prague were attacked in 1290.

The Jews were draining Europe at every point left open by Christian ecclesiastics, who took benefice, tithe, and church dues, on land and produce, besides commanding direct service. If the one grasped by domineering, and the other by over-reaching, the results may have been very similar in impoverishing the people and the nobles, but the means and modes were different, and the profits went in different channels. In England and in France the Jews were often attacked, and their banishment was a mode of saving them from the punishment they deserved. They had imagined that civilization would allow Jews to reduce families to ruin, to starvation, and to death, and protect Jewish life at the same time. The Jews had a virtual monopoly of money-lending till the arrival of the Caursini, who were perhaps partly Mantuan.

Jews, and were fraudulent also. During famine and dearth, or for some impending military service, the baron would wish to borrow money and purchase food for the sufferers on his estates, or for his men leaving home, and was compelled to raise it from some Jew on the security of a mortgage, while a rate of perhaps 100 per cent. was asked as interest (instead of about 20 per cent. which in this century would have been ample). Can we wonder that the baron sent his proposal to pay 20 per cent. by the hands of some persuasive dentist? It was not unjust, for the Jew that could lend at one rate could lend at the other. Can we wonder that in some cases, when the Jews refused advances with the aim of raising rates, that the masses fell on the Jews and killed them? The reasoning of the people was quite sound; the Jews were money-lenders, and if money-lenders would not lend at a reasonable rate, they should be expelled or removed; they were like bakers that would not bake, when the people were starving. The small massacres of this century were due to the customs of the period, and were not perpetrated on Jews alone. The Genoese massacred all the Venetians in Constantinople in 1296, out of commercial and local jealousy; there were also numerous religious massacres, those of the Amaurists at Chartres, and the Pastoureaux at Bourges, besides the Albigeois, Vaudois, and of six North Italian sects. Surely if the Pope, head of the Western Church, enjoined massacres of Christians, the massacres of Jews could not be incorrect. Brutality was a feature of the age; hanging was re-introduced in England and in France; drawing, quartering, and in cases crucifixion, pillory and tumbril, if not novelties, were generally adopted in England.

Next, as to the ecclesiastics, headed by abbots and bishops, and backed by the Pope and the Holy Office. Their aim was to acquire as much freehold property as possible, to obtain by gift and dying bequest and by purchase, until the land was mostly or entirely owned by them; the people, king, and barons would then be subject to them, and a more substantial support of the Papacy than mere tithe would be permanently at the disposal of the clergy. This was the plot of this century, disguised under religious expressions and terms. Had it been successful, Europe would have been entirely reduced to a servile condition, like the community of escaped Brazilian slaves under the Jesuits in Misiones, Paraguay, toilers, without a hope or an aspiration, performing labour

mechanically as beasts, while the profit went to church building and to ecclesiastical support. They might then truly become the sheep of the clerical pasture, under the rule of the terrestrial deity, the Pope. It was not a novel notion; Edward the Confessor alienated English lands till England was defenceless. The Anglo-Danish and Anglo-Norman conquerors of Neustria, Le Maine and Bretagne, had been prodigal to the Church. The Franks were more careful, so were the Flemings, but they gave also. There had been a reason for this before, though an insufficient one; the people were very ignorant in the ninth and tenth centuries, emerging from the barbarism of the black ages, and the Church supplied educators to raise them, bringing teachers from other countries and training others through them; but those times had gone. The knights were superior to the monks and canons in knowledge, and had all the latter vanished, the people might have been taught by the knights in less clerkly and more manly mode. The autocracy of the Papacy, and its compulsory support, was the leading aim. It had been suppressed by Arnold; many sects refused tithe everywhere; and in England there was a king, having notions in advance of his times, John the Liberator. Any national repudiation of Papal command would, if not suppressed, be followed by that of other nations; and tithes might vanish entirely if the land were not in the hands of the clergy. The greed was not altogether personal, and the efforts were based on the notion that the fall of the Papal sway would be a serious loss to Christianity; but pious excuses could not conceal the aim. Religion and religious teaching were not the object. Could it be denied that the clergy shared in the gain from the increased acquisitions of the Church? The existing wealth of the Church was enormous, relatively to the total wealth of any nation. The White Monks could pay £40 000 to the Council of Bridewell in 1210, or relatively three-quarters of a million sterling; the clergy had to pay £1000 in benevolence. The further land-grabbing of the clergy was eventually stopped in England by the Mortmain Act of 1279, and the Statute 'Quia Emptores' of 1290; afterwards by the Wycliffite and Hussite reactions. King John had, however, started the whole opposition.

He had also suppressed the Jews in Cornwall, who for a long time had kept the miners in a state of serfdom. Other good deeds of this nature were also done by him, though the results were transient.

The financial condition of Hungary, another country strong during the past century, became ruinous under Andreas II. after 1205, and rendered it helpless to oppose invasion and conquest in 1241 to 1294. A bureaucracy and a hierarchy domineered over the land, and drained it of all wealth. Every official post was controlled by the bureaucrats, and all officials could plunder and tyrannise. The priests and monks took in other ways, not open to officials. Even tolls were mortgaged, and the coinage debased. At the return of Andreas from a Crusade, 1219 c., the country was ruined, and even the results squandered. Afterwards the bureaucrats built small forts, whence they could tyrannise more safely. The nobles and the people were ruined, and their revolts were ineffective, so too the royal or Golden Bull of privileges. The wealthy bureaucrats attempted to depose King Bela IV. in 1236, and nearly succeeded. Their ill-gotten gains made them powerful politically. When the Mughals advanced to conquer Hungary, the Magyar nobles not only had no money as sinews of war, but positively refused to defend their country. It was a heart-broken land, in which only officials, priests and monasteries could flourish. The bureaucrats were still in power in 1280, after the great invasion; and the brigand chiefs were not suppressed till 1312.

The condition of Denmark, a country strong in the past century, like England and Hungary, was analogous, financially, from 1241 to 1334. Not only were there some revolts against taxation, and some simple civil wars, but a priestly party with Papal support kept the country in a state of semi-religious war during that long period. There was a markedly strong rebellion of priests in 1256, and their party poisoned King Christopher I. in 1258-9; the Papal interdict and the priestly broils lasting till 1274. There was another such rebellion in Sleswik in 1285. A rebellion headed by a bishop in 1295, and a Papal excommunication for imprisoning that bishop, were events near the end of the century, that did not entirely end the priestly and Papal opposition; for even as late as 1333-34, King Christopher II. was excommunicated by that faction. Denmark suffered not only direct from this semi-religious war, but her weakness enabled Norway and Sweden to acquire some of her territory, permitted the revolt of both East and West Pommern in 1223, and induced the loss of part of Livonia, which she assigned to others, as she could not defend it.

Three out of four of the strong countries of the past century were thus wholly or partly ruined by ecclesiastical greed. In

the prosperous old detached Flemish duchies, Holland and Hainault, Flanders, and in the newer Lorraine duchies of Brabant, Luxemburg, Limburg and Namur, it is difficult to trace the effects of priestly and monastic attempts to domineer and plunder during the century. The weaker and less prosperous countries were perhaps purposely neglected, but in others, the depressed financial condition was due to the above-detailed causes.

The Hansards were steadily rising throughout this century. They were fully established in Germany in 1241, and their league was signed there in 1247. They formed their first English trading depôt at London in 1250, obtain special privileges in England in 1259, and in 1266 some extension of them. Their English Royal charter dated from 1280; and so thoroughly were they picking up all the foreign commerce, that in 1290 there was a petition of citizens of London for the expulsion of alien merchants. In this case these were Germans, for the Flemings had not yet joined them collectively. As for the national exchequer, it was always very low, for the Parliament prevented the English King from raising money without their consent, and would not raise any for him themselves. A few nobles would occasionally help with "benevolences," the regalia could be pawned, and royal rights and claims might be sold. The Popedom had loosed subjects from their allegiance to monarchs, and encouraged them to withhold support; for the Papacy wanted all the allegiance and support for itself alone.

Science in this century developed itself a little in Christian Europe; for if we compare the attached lists of Moslem and Christian scientists of this century with those for the past century, it seems that a balance at least had been attained. But this was only among the pioneers of science. The Moslem masses had the science of five centuries to profit from, and were well informed; the Christian masses either persecuted their scientists or left them to ruin themselves during their lives of research and study, but did not follow them. When a Moslem scientist, or even a mere compiling annalist, poet, or jurist, presented his work to a Moslem monarch, a reward of 500 or 1000 dinârs, even more sometimes, was given to him; but the Christian scientist was allowed to starve, or put in prison on some plea. There was no State encouragement of science; it was too often the toy for the leisure of some comfortable monk or priest, persons least suited to it.

The Christian additions to science were in the first instance translations from Greek and Arab authors, as those of Athelard, and Gherard of Cremona in the past century ; in which only Alexander Neckam, and perhaps Alan of Lille wrote original matter. In the thirteenth century also the algebra of the traveller Leonardo Bonacci, the astronomy of Alfonso of Castilla, and the science of all the Christian alchemists was taken from the Moslems ; Roger Bacon was much indebted to the Moslem and to the ancient Greeks. But there was also some new matter, both original and new from development. John de Sacro Bosco seems to have been an originator ; also Francesco Stabili, who was burnt alive ; and John Peckham, who, being an archbishop, was comfortable. Bacon made new developments, and spent ten years in prison for them. Peter of Abano and Brunetto Latini, also Albertus Magnus, were originators to some extent ; but the metaphysicists or moral philosophers of this period were too often reproducers, either sunk in astrologic twaddle, or in a combination of Aristotle's method with ecclesiasticism. Yet some germs of Cartesian philosophy had existed in the works of Anselm.

It is very remarkable that the Byzantine Greeks contributed very little to science, and that their language even was not introduced. Also that so few of the ancient Greek authors contributed direct to form a basis for science in modern Europe.

The translations of Ptolemy's 'Almagest,' and of Euclid's 'Optics,' were the foundations of the skill of Roger Bacon, whose magic-lantern lenses were the forerunners of spectacles, telescopes, and scopes of many sorts. Chemistry was confined to a few secrets in the possession of a few philosophers. As to botany, perhaps there were some plants introduced from the Levant into Europe by the Crusaders and pilgrims.

Education consisted of a knowledge of mediæval Latin taught by the clergy ; but a library was founded at Salamanca, and several academies in France. One branch of useful education received a start, by the Parisian College of Surgeons of Pitard in 1271, and the Medical Florentine College of S. Maria Nuova in 1286. Lanfranco of Milan, b. 1240 c., was a skilful operator. Guilds of craftsmen rose everywhere.

Construction and building followed the same course as that in the twelfth century ; things were made larger and better in some respects, but the novelties were few. In England the first stone bridge was at last finished, a thing that was not yet wanted, as timber was still plentiful. In Venice the Rialto

bridge was begun 1242 c. Improved conduits were made in England, and a canal near Milan. Large cathedral churches were built in every country.

If the Fine Arts were generally as in the past century in Europe, Italy was an exception; for in this century painting was introduced there from the Byzantine Empire. It had long existed in England (*see* Tenth Century, Roger the monk, &c.), and even painting in oil had been there kept up to some extent, as proved by records of the Painters' Company of London (*see* 1283); also it had thence spread to Bohemia (*see* 1297). But in England, perspective was a novelty of the year 1279.

Italy was in advance in bridge building at Florence and Venice, but sadly in arrears in painting. Apparently there was none at all before the time of Margaritone and Giunta, 1240 c. Probably the Byzantine Greeks had kept their arts secluded; and only at the fall of their empire in 1203 c., could these be acquired. Perhaps some Venetian sculptor or architect brought away specimens of paint, and of painting; or some Greeks may have practised the art of painting for some little time in Italy after 1203. However it may have been, the processes introduced did not include painting in oil, but in fresco on a ground prepared with chalk and glue on a panel, also gilding burnished with bole, and mosaic work; the two former were introduced by Margaritone, the third by Tassi.

The early Italian painters were sculptors and architects that adopted painting on panel, with a prepared ground, as a mode of internal decoration; their subjects were single figures in a flat style, with a little gilding in parts. Perspective, both linear and aerial, were unknown to them; in fact, they were only doing much as Dunstan's monks did in England, with a far smaller knowledge of means, mediums, and processes.

The earliest painters in Italy were the following:—

Jacopo da Torrita, Siena, mosaic 1205 to 1275	Giovanni Cimabue, Florence, pr. 1240 to 1300
Margaritone of Arezzo, pr. and sc. 1212 to 1289	Gaddo Gaddi, Florence, pr. and mosaic 1239 to 1312
Giunta Pisano, Pisa, pr. <i>f.</i> 1229, d. 1255	Duccio di Buoninsegna, Siena, pr. 1260 to 1340
Andrea Tassi, Florence, mo- saic 1213 to 1291	Giotto du Piombone, Florence, pr. and sc. 1266 to 1336
Guida da Siena, Siena, pr. <i>f.</i> 1221 to 1230?	Oderico da Siena, miniature pr. <i>f.</i> 1213
Ursone da Bologna, Bologna, pr. 1226 to 1288	Oderisi da Gubbio, miniature pr. d. 1299
Manno da Bologna, Bologna, pr. and sc. <i>f.</i> 1260	

It may seem surprising that the works of these painters, or even their names, should have been preserved with such care and reverence, long after the period in which Italian painters had studied anatomy and perspective, and had really learnt to paint things worth looking at. Even allowing for the effect of time on the best of these surviving pictures, they can never have been good really. But pictures of Madonnas came in with painting, and the semi-pagan cultus of the Italian reverted to the ancient Roman woman-worship with delight; the subjective condition of mind put the halo of charm, combined with religion, around these pictures; hence the fond attachment, and the reverence.

There was also in Italy much improvement in sculpture during this century. Hitherto the semi-Gothic figures were probably inferior to those in other countries, certainly to those in English churches and cathedrals, minsters, &c. Some of the Italian sculptors were painters, others architects. Besides the four already mentioned, there were Arnolfo di Lapo of Florence, Agostino da Pisa, and Giov. Balbucci, also Pisan; Ventura da Bologna; Agnolo, brother of Agostino; but the credit of higher art in sculpture is assigned specially to three men, Niccolò Pisano, called dell' Arca, d. 1275; his son, Giovanni Pisano, d. 1320; and a third, Andrea d'Ugolino Pisano, b. 1270, d. 1345; the three forming its steady development; though Italian painting of a higher class began later, in the middle of the fourteenth century, under Orgagna.

As to the music of this century, apart from the lyrics of the troubadours, it is difficult to discover anything about it. The poets and troubadours were Adam of Barking, poet in Latin; Meo Abbraccio-vacca da Pistoia, poet in mixed Italian and Provençal; Francesco de Barbarino, Tuscan; Albertet, the Provençal; Guillaume de Cabestan, troubadour at Roussillon; Thibaut of Champagne, king of Navarra; Enzo of Sardinia; Fra Guittone of Arezzo, poet in vernacular Italian; Jacopone di Todi, writer of the *Stabat Mater*; Guido Cavalcanti; Guillaume de Loris; Matthew Paris; Roger Bernard, the troubadour; Sordello of Mantua, prize-winning troubadour; also Jacques van Maerland, the earliest Flemish poet; Tomasin, a German poet; and Konrad von Wurzburg, Minnesinger and epic poet.

Leading Moslem Scientists of the Thirteenth Century.

Abdul Latif—physician, traveller, author of 150 treatises . 1261 to 1326
 Abul Hassan Ali—astronomer, author of an astronomical treatise . . . *fl.* 13th centy.
 Badruddin Balbaki, Syrian—physician, writer on the sinews and nerves *fl.* 13th centy.
 Ibn Bitâr, *b.* Malaga; *d.* Darnaslik—physician, naturalist, botanist, mineralogist, metallurgist, writer on the medical properties of animals and of plants . . . *d.* 1248
 Izzuddin Khâlid Khâni, Persian?—translator of Hindi treatises on astrology and philosophy . . . *fl.* 1290 c.
 Muwâfikuddîn, ibn abu Useba

—physician, translator of Sanskrit works on physic and physicians; author of a medical treatise, biographer of physicians since the time of Aisklepios *fl.* 1220, *d.* 1269
 Nasîruddin al Tûsi (Khwâja)—mathematician, astronomer, maker of improved instruments, philosopher, translator of the books of Euclid and the Almajisti, writer of the Ilkanian astronomical tables . . . 1201 to 1274
 Shahâduddin abu Abdalla (Yakût) Greek—author of a geographical dictionary *d.* 1229
 Zakkariâ bin Muhammad Kazvini, Arab—naturalist and author . . . *d.* 1283

Leading Christian Scientists.

George Akropolita, Constantinople—scientist and philosopher . . . 1220 to 1282
 Albertet, Provençal—mathematician and poet . . . *fl.* 1289
 Albertus Magnus, Suabian—alchemist, naturalist, cyclopaedist . . . 1205 to 1280
 Alfonso el Sabio, Castilian—astronomer, philosopher, wrote astronomical tables . 1203 to 1284
 Salvino degli Armati, Florentine—inventor of spectacles *fl.* 13th centy.
 Arnold, of Villa Nova, lived in Southern France and Genoa—alchemist, physician, astrologer, philosopher 1235 to 1315
 Roger Bacon, *b.* Ilchester—mathematician, chemist, mechanist, translator of Arabic and Greek books; founder of experimental philosophy, analyser of Moorish gunpowder, inventor of lenses, the magic lan-

tern, an aspiring trombe, the Eolipile, and of a phosphoric substance 1214 to 1294
 Gerald du Barry (or Giraldu) —naturalist . . . *fl.* 13th centy.
 Guido Bonati, Florentine—astronomer and astrologer *d.* 1300
 John de Sacro Bosco, English—mathematician, first Christian writer on astronomy, geodesy, and on the calendar . . . 1190 to 1256
 Leonardo Bonacci, Pisan—traveller, mathematician, author, introducer of algebra among Christians *fl.* 13th centy.
 Isaac, called of Holland—alchemist and philosopher . . . *fl.* 13th centy.
 Brunetto Latini, Florentine—writer of a cyclopaedia of science in French 1230 to 1294
 Raimondo Lullo, *b.* Palma, Majorca—mathematician, physicist, alchemist, proposer of chemical units and proportions; explainer of the mode of making aqua-

[fortis, writer on the Kabala
 and on magic; traveller in
 Africa 1234 to 1315
 Raimond Martini, *b.* Toledo—
 Christian linguist in Arabic
 and Hebrew *f.* 1250
 Matthew Paris, English—ma-
 thematician and historian,
 &c. *d.* 1259
 John Peckham, English—first
 writer on perspective in
 1279; also wrote on optics
 *d.* 1292
 Peter, called of Abano, lived
 at Padua—scientist, physi-
 cist, and philosopher . 1250 to
 1316
 Guglielmo Saliceti, *b.* Pia-
 cenza, *d.* Verona—physician,
 surgeon, and author, inven-
 tor of a new mode of ex-
 tracting stone; he used the

Greek and Arab modes of
 iron and fire (actual cau-
 tery?) in surgical cases. *d.* 1280
 Sir Michael Scott—alchemist,
 astrologer and philosopher,
 naturalist, writer on phy-
 siognomy *d.* 1291
 Alessandro della Spina, Pisan
 monk—improver of the
 spectacles of degli Armati *d.* 1315
 Francesco Stabili, called Cecco,
 of Ascoli—scientist, astro-
 loger, author of a compen-
 dum of physics, natural
 history, philosophy, astro-
 logy and visions . 1257 to 1347
 Theodoric (perhaps Sicilian)
 —surgeon, who used anæ-
 sthetic fumes *f.* 1270
 Vitello, the earliest Italian
 writer on optics . *f.* 13th centy.

POLITICAL CONDITION.

The conditions were specially unfavourable to progress in every way. The political condition was perhaps the worst possible. The advanced posts of Europe in Asia, the Latin princedoms of Syria, were driven in perpetually, until none remained in 1291; the wretched hordes of Khwarazmi and the Egyptian Mamluks could always suppress the small garrisons; and the great error had been in the original occupation of untenable posts, not fit for colonial settlement of Europeans. The revenge for the massacres of Christians should have taken the form of a victorious campaign and a withdrawal to some defensible port. The strategic error was incidental to the Crusading mania for visiting shrines.

Besides, there was a new invasion of Europe. It is true that it came through Kipchak, which had been occupied by Mughals for centuries, and was a European Christian country; but the hordes of the Mughal army doubtless came from Asia, chiefly from Chinese or Eastern Turkestan, Little Tibet, and Western Turkestan, besides from the White and other Mughals of Tartary proper. It had been invited by murdering envoys, and there had been an assumption by the Europeans of the Greek rite that the Asiatics of the Nestorian rite were less Christian than themselves, and to be treated as savage heathen. The letter of Changez Khan about the Western nations chafes at this, long after his revenge had been executed. (A similar assumption of the Portuguese of the Romish Church led to the massacre of Nestorian Christians in India, soon after they entered in the beginning of the sixteenth century.) It was an error, and even the Papal envoys to the Nestorians carried these pretensions with them, in expecting them to submit to the extent of accepting a Papal blessing, without having asked for the blessing of the Great Kaïn on the Pope. Europe was still small and sparsely populated, besides being disunited. After the revenge on the Russian duchies, Kipchak territory was extended to Wallachia and Bulgaria; Pohlen and Hungary underwent perpetual ravage,

worse than occupation, till the end of the century; also the Hungarian and Polish provinces. Bohemia, Silesia and Moravia checked the great Bedu, and showed him the limit of the power of his armies.

Bohemia was the leading European power in this century, and extended from Königsberg in Prussia down to Austria, Styria, Carinthia and Istria, in opposition to Germany. The Bohemian acquisitions had been fairly obtained by inheritance and by purchase, and its position among nations by defeating the Mughals, but the territories were taken by the Habsburgs in 1274, and Bohemia again became an Imperial electorate in 1287, after acquiring part of Misnia and Eger.

France, a country newly formed under Philippe Auguste at the end of the twelfth century, became a large territory through a series of encroachments and annexations throughout this century. It did not obtain them by war and conquest; in fact, the French were particularly unsuccessful in any serious campaign or war, and always had been so; it was an unwarlike race, that rarely gained a victory through prowess. Defeated and expelled from England by a mere handful in 1217; crushed in Egypt in 1250; again in Tunis, 1270; the only important success was at Grandella and Tagliacozzo, against the weak regency of Manfred, and the boy Konradin, and circumstances then favoured this unprovoked French attack and conquest of Naples and Sicily. It was supported by the Guelphic Papal party, who wanted the extinction of Imperial power in Italy. The Germanic Empire was in the extreme state of weakness and dismemberment; the conquest was easy. The results, however, were not lasting; the French were expelled by the Sicilians in 1282, and defeated by Roger de Lauria in 1284; though a chequered rule, in Naples alone, continued for a century.

The French, brave in attacking sick men, also robbed and annexed at convenient opportunities. Other nations had occasionally done such things, but France was especially the criminal one among nations. Its exploits were these: the intrigues to cause the revolt of the boy Arthur against the English in 1200; the slander spread about the death of Arthur in order to cause the defection of the nobles of Normandy, Maine, and Anjou from the King of England in 1203, and the two resulting annexations; the seizure of Aquitaine in 1204, during the English civil broils; the earlier attempt on the crown of England through female and priestly intrigue,

1204 to 1208; the series of brutalities on the Albigeois, 1207 to 1213; the unprovoked attack on Flanders, 1214; the attempt on England through a faction of discontented nobles, 1215 to 1217. These deeds were due to Philippe Auguste, who had done similar things in 1192 to 1199. But his successor, surnamed the Lion, was very like him; he seized English territories in Limousin, Perigord, and Guienne in 1224; and committed gross atrocities on the Albigeois in 1225. The sainted Louis annexed Provence and part of Languedoc in 1229, through a forced marriage of the daughter of Raymond VIII., though it passed to the Count of Anjou in 1245; the attempt to annex Bretagne in 1231-37; the unprovoked attack on Naples and Sicily in 1266, and murder of Konradin. Even this saint had a conscientious scruple, and restored Limousin, Perigord and Guienne in 1259, out of such a score of robberies. Philippe le Hardi took advantage of the English baronial broils and its resulting weakness, to annex the rest of Languedoc, Toulouse, and Poitou in 1271. Philippe le Bel seized some English territory in Guienne in 1294, and all Flanders in 1299. These piecemeal filchings were followed by successive filching to obtain the English crown through the marriages of Marguerite and Isabel with Edward I. and Edward II. in the fourteenth century, when England regained strength, and might otherwise have taken accumulated vengeance.

France had by foul means gathered territory together, and had temporarily become a powerful nation in the thirteenth century. Its origin was never forgotten, until the land was again reduced to the original possessions after the battle of Poitiers in 1356. But it had been quite a new principle. Hitherto, kings had conquered fresh lands, France had stolen them piecemeal; and its measures was triumphant for a long time.

Spain was, however, both successful and fortunate; the united Christian armies defeated the Moors severely at El Akab, 17 July, 1212; and from that time till 1273, the Almuwahād dynasty were opposed in Africa, and extremely weak in Spain from civil war; hence the Christians attacked and annexed territory with ease. Also the Spanish Moslems helped the Christians against the Moors from 1248 to 1257. Even Murcia, Algarves and Majorca were annexed in 1266 to 1268. But then the tide of success turned. In Castilla there was revolt and civil war. The Spanish Moslems had brought over the Merines from Fez for a campaign which lasted from 1257 to 1294, in which both the Castillians and Aragonese were often

defeated, and lost Andalusia and Seville. Even after the return of the Merines, the Spanish Moslems were successful from 1294 till the great struggle of 1333. But Christian Spain had succeeded in localising the Spanish Moslem and partly cutting him off from the African; and this was the prelude to further success.

There was hence hope for Europe against Africa, though Asia might yet send numberless hosts to destroy the Western civilisation now taking firm root.

There was, however, one very great achievement done in this century; virtually it was a Danish and German Crusade against pagan tribes of Europe, in Livonia, Lithuania and Prussia, and a successful one; correspondingly, too, the Swedish subjugation of the Carelians and Ingrians. The Baltic provinces were acquired, and the pagan Letts were driven out of much of their original territory by the Knightly orders, after about fifty years of warfare. It was glorious in itself, and proved that if Europe had been driven in beyond sea in Syria, it was not because manly effort and vigour had died out. The Emperor Frederic understood the situation; so did Prince Edward of England.

Europe was also seething with all the elements of civil war. Priestly domination, Papal arrogance, had to be met by sovereigns, often unaided. Baronial revolt and factious party fight might at any time disturb any country. In Italy, where the German Empire was sovereign, the Pope inflamed the towns, cities, and small states to throw off allegiance; in England a French sovereign was nominated, and all English possessions in France were successively seized under Papal counsel. Almost every country in Europe was put under Papal interdict at some time, and many sovereigns were excommunicated. It was not a religious question in the main, but one of tithe and benefice everywhere. In the extreme case, that of the Stedingers of Oldenburg, they were massacred because they refused tithe. All the sects most objectionable to the Popedom that underwent persecution, were refusers of tithe, and supporters of *frank-almoign*. They were derived sects, resulting from the Arnoldism of the century before, in North Italy and the South of France. There were others, but the Holy Office discovered less wickedness in them usually. We must remember, while considering the tenets of some of these sects, that many of the Romish dogmas had only been recently formulated, and that hence some sects were

virtually old Catholics ; more especially some of the Apostolians, in their three successive orders. There were also many really degraded schismatics.

France, which had shown excessive greed, and had grasped much during this century with Papal countenance, was obliged to put some limit to Papal greed within its own borders. Even the saintly Louis had in 1269 to defend the Gallican Church. Denmark was bullied into abject submission. It may be surprising to some that the middle classes, or perhaps the masses, did not rise on the side of their rulers, and banish the priestly nominees of the Italian. It might have been so, had not the ecclesiastics already gained much of the land and most of the money ; they were masters well provided with the sinews of war ; and then, also, there was the superstitious objection. The masses were abject, the middle classes were yet not wealthy ; the knights, gentry and Barons had no cause for direct interference, and many persons of their families were even ecclesiastics, thus a bond was preserved. Besides, the Barons and gentry had a permanent grievance of their own with which they were fully occupied, their rights and privileges were continually being overridden by the King and court ; an alliance with the ecclesiastical party was absolutely necessary to their existence. It was much alike everywhere in Europe ; monarchs might be strong on their warlike expeditions, but they were very weak at home.

There was much plague, sickness, and even leprosy still in Europe, besides much famine ; blindness seems to have been common among military men, perhaps those that went to Egypt, as the establishment of the Parisian hospital of the *Quinze-vingt* in 1260 proves. There was also founded in this century the *S. Gothard hospice*, and the *Florentine Ospedale della Misericordia* in 1244. It is difficult, almost impossible to discover which were specially the leper hospitals, even in England, though there is no doubt that the *Sherburn Leper hospital* founded in 1180 near Durham by *Pudsey* was not the last of its class, and that lepers existed in England during the thirteenth century ; it is very doubtful whether lepers were not later treated in some special way. Leprosy did not vanish of its own accord after all the crusading expeditions ended. The Medical knights stopped it. Apparently this achievement was chiefly the result of their efforts in this century ; the modes and means they adopted are not fully known. It is clear from the attached small list, that most of the chief

English hospitals founded in this century are in the earlier part of it. The conclusion is that they supplied the wants of that time sufficiently, and that sickness lessened afterwards.

Hospital S. Thomas—London, rebuilt	c. 1207
Gresham Hospital—Durham	1220
Maison Dieu—Dover	1227
Hospital St. Mary—London, of Walter Brune	1235
Hospital—Monmouth, Fitzbaderon	1240
Hospital (a second)—Monmouth, Fitzbaderon	1240
Hospital of S. Edmund—Gateshead	1240
Hospital of S. John—Glastonbury	1246
Bethlehem Hospital—London, Fitz Mary	1247
Hospice (for travellers) of Maidstone	1260
Hospital S. Katherine—London, Eng.	
Q. Eleanor	1273

A remarkable institution was founded by Pietro Borsi da Lucca in 1240, the *Compagnia della Misericordia*, for giving instant help in cases of sudden illness and accident in the town of Florence. Apparently sudden death was not uncommon at this period, and was often attributed to murder or to witchcraft; for this was quite a vice of the ignorant. The Italian institution was never adopted elsewhere, till the London ambulance arrangement of the nineteenth century, by any private body.

Weapons poisoned in the Saracenic way were used by the Lambertazzi of Bologna in 1273, and many deaths of Crusaders may have been attributable to this cause.

Plague and famine ravaged Europe and England in 1221; England in 1235 suffered from both; but the effect of plague in some European countries cannot be easily traced in this country. There were periodical famines and dearths everywhere; but whether most of these were directly due to actual deficiency in the harvest of food crops, cannot be safely stated. It is however quite evident that the absence of fitting communications between countries, roads, canals, and sufficient shipping, prevented such famines and dearths from being substantially relieved. The famine that slaughtered thousands was, in the sight of the Jew, a most profitable affair; he did not want to relieve it, that would not be business; his aim was to control the prices on a small amount of import, and to lend money to the needy at exorbitant rates.

RECORD OF PROGRESS AND EVENTS

1200 TO 1299.

PERIOD OF THE MUGHAL CONQUEST.

1200. **England**—First general adoption of chimneys, introduced at Rochester Castle in 1180; this adoption perhaps was similar to the original, in a number of the larger castles, and not in houses generally. *See* 1300. Woodblocks are used for printers' monograms. *See* 1100. Surnames are now generally taken by the common people; these are mostly names of crafts and occupations—as Archer, Baker, Carpenter—or nicknames, also names of the places of birth of persons that had migrated from them. The Synod of Westminster decrees that banns of marriage shall be thrice published in local churches.

1200. **Papedom**—Papal dispensations for crime can now be procured; this was not a mere absolution, but had other effect, as long as the clergy had any judicial power.

1200. **Spain**—The sciences Astronomy and Geography, introduced through the Moors, are now cultivated by Christians. At this time Abu Abdallah had just succeeded Abu Yûsuf; Alfonso IV. had long ruled in Castilla, and Pedro II. in Aragon. Probably the Arabs who really did cultivate science, and translated both Indian and Greek books, and formed immense libraries, were the formers of these two sciences, which were handed on through the Moors.

1201. **England**—Many towns are now incorporated under charter, an old Roman British custom. Enfranchisement of Cornish miners, who had been reduced to serfdom by Jews; miners also are granted the right of search for ores on all domains; the liberator is King John. The Papal decree, ordering prostration at the elevation of the "hostia," now takes effect.

1202. **Denmark**—Riga is now founded by Bishop Albert, in Livonia. The settlement among the pagan Lithuanians was effected by Kanut VI. and the Markgrave of Brandenburg in 1198 a., after a partial conquest. The Livonian knights were of the orders of Portglaive, founded 1196; of Christ, founded 1200; of Swordbearers,

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also called Gladiators, founded 1204; also the order of Portglaive was reconstituted in 1212. This was a Crusade of a special sort.

1202. **Europe**—The Fourth (or False) Crusade preached by Innocent III. to obtain the Saladin tithe. The leaders were Emeric king of Hungary, Foulque of Neuilly, Baldwin of Flanders, Eudes, and Geoffroi de Villehardouin: the Venetians diverted it.

1202. **Spain**—A Papal interdict (probably a second one) is put on Leon, which lasts twelve years, 1202–1214.

1202. **Mughals**—Rise of Changez Khan, the future invader of Europe, who defeats and kills his father-in-law, Avank Khan or Ung Khan, or Malik Yuhanna (Prester John), Christian emperor of Little Thibet and all Tartary. At this time there are Mughals in Europe east of the Volga (Kipchak).

1203. **England**—Current prices of food are determined and declared from time to time by tribunals, termed the Assize of Bread. (A proclaimed current price has been an Eastern and Indian custom for ages, to prevent unfair charges.) It is supposed that this was of Oriental origin. Parliament again acquires some permanence as an institution.

1204. **Popedom**—Papal Inquisitors of the Holy Office are first appointed now; they enter various countries thus: France in 1221; England admits the Dominicans in 1221; Sicily, 1224; Aragon, 1233; Venice, 1249; France again in 1255; Castilla in 1290. Rise of the Latin Empire of Constantinople under Baldwin.

1205. **Germany**—Strassburg becomes a Free Imperial city; these free towns had their own municipal governments; and were freed from the authority of the Duke of the province, being responsible direct to the Empire, and sending representatives to Councils.

1205. **Hungary**—Rise of an official oligarchy allied with the priesthood, which tyrannise over the nobles and people. They succeed in dominating and plundering everything, in spite of revolts, until the country is ruined. The Golden Bull of 1222 was ineffective to restrain them; they even endeavoured to depose the King in 1236. They had made small forts and ruled everywhere. In 1240 the nobles and people were so weakened and disheartened that they refused to defend the land against the impending Mughal invasion. The officials attempted in 1291 to depose King Andreas III., and had formed a series of brigand chiefdoms all over Hungary. Their suppression was gradual after 1309 by King Charobert the Anjevin.

1206. **Languedoc**—Count Raymond of Toulouse protects the Albigeois from being harassed; at this time the anti-Romish sects held Toulouse and eighteen towns in Languedoc and Dauphiné. Pope Innocent III. enjoins extirpation in 1207. Arnaud (or Amalric) besieges and takes Beziers in Languedoc in 1209, massacres 60 000 Albigeois, and burns the town. Count Simon de Montfort leads troops in 1210 against the Albigeois, but is opposed in 1213 by Pedro II. at the battle of Muret. In 1217 the people of

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Toulouse revolt, expel De Montfort, and recall Raymond VI. Count Montfort is killed at the siege of Toulouse in 1218.

1207. *Germany*—Poetical and musical contest of Minnesingers at Eisenach.

1207. *Piedmont*—Beginning of a persecution of the Valdenses, or Vaudois, a sect that had much increased in Piedmont in 1120, and spread to Bohemia in 1178, and against whom the Council of 1198 had decreed that they should not buy, sell, or trade.

1208. *England*—The edict of King John liberating England from bishops and clergy appointed by the Pope, is followed by a Papal interdict lasting from 28 March, 1208, to 6 December, 1213. The priestly party calumniate the King, and the ignorant masses are alienated from allegiance. King John submits to humiliation in order to end the interdict in 1213.

1209. *England*—The first of the modern English stone bridges is completed near London, probably at Bow, thirty-three years after it was begun. Bull-baiting is practised at Stamford. The Pope offers the crown of England to Philippe of France as a gift.

1209. *Italy*—Silk manufacture is introduced into Venice from Constantinople (but silkworms had before been brought to Sicily). *See* 1146.

1210. *England*—English laws and customs are introduced in Ireland by King John, after subduing some rebellion. The council of Bridewell enforces a benevolence of a thousand pounds from the clergy; it reduces the White Monks, and enforces them to pay forty thousand pounds of silver; apparently such was the usual way of raising national funds.

1210. *Mughals*—Changèz Khan (*see* 1203) is now Kañ of all Tatars from the Volga to China, by election; he had ravaged and conquered part of Tatary from 1206. He is thus already monarch over a part of Europe, and may have been so before.

1213. *Mughals*—The Mughals, who now first attack Northern China, use improved cannon, made, according to repute, by Western craftsmen; the cannon and perhaps the powder are far better than those of the Chinese.

1214. *England*—Convocation of Barons at Bury, for restricting royal power, and for the recovery of the ancient Anglo-Saxon privileges that had been obliterated by Norman feudalism.

1215. *England*—The first English society of free merchants is established at Newcastle by grant of King John; a second in the year after in London. The Forest laws (Rapin) allow landowners to make rabbit-warrens on their own lands. The Court of Common Pleas is now permanently settled at Westminster Hall. The Royal Convention with the Barons grants partial restoration of Anglo-Saxon privileges, and restrains the court-purveyors; it modifies the land tenure, abolishes aids (to public funds) without the consent of the Great Council, and modifies amercements.

1215. *Spain*—A library for students is established at Salamanca (Enrique I. temp.).

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1215. **Italy**—The Fourth Lateran Council of 1215 fathers declares that the opposers of the principle of obligatory confession to a priest are heretics ; this renders them liable to the processes of the Holy Office. Orders are given as to the collection of Church tithes.

1216. **Popedom**—Pope Honorius III. establishes the sale of indulgences, and the Papal canonization of saints.

1217. **Europe**—Preparations for the Fifth Crusade by Andreas II. king of Hungary, Leopold of Austria, and Ludwig I. duke of Bavaria. Damiad is besieged by 200 000 men, from 5 July, 1218, and taken on 5 November, 1219. Some concessions about pilgrims are obtained. The Egyptians recover Damiad in 1222.

1218. **Bohemia**—Przemislav, who had annexed Moravia and become king in 1198, is now freed from tribute, after defeating the Emperor Otto IV.

1218. **England**—Trial by Ordeal is formally abolished ; but trial by Battel replaces it in cases of presumed treason of any sort.

1220. **Denmark**—Expedition to Livonia ; defeat of the Esthoni-ans. Revel and Narva are built, and the whole Baltic coast from the Elbe to Narva, with its countries, including East Pommern, is subject to Waldemar II. But during his imprisonment, in 1223 to 1226, the whole of these Baltic provinces acquire independence, partly under the Teutonic knights. This closes the results of the Lithuanian Crusade of 1198. *See* 1202.

1221. **England**—Four unfortunate religious maniacs are crucified for imposture. Probably this was effected by the Dominicans, who now enter England (*see* 1204), but are not entrusted with the powers of the Holy Office until 1233.

1223. **France**—Emancipation of all slaves in France after the accession of Louis VIII.

1223. **Popedom**—Pope Honorius III. issues a decree of opposition to the Albigeois.

1224. **Mughals**—Changez Khan intends to attack the Polovtsi, and sends envoys to make alliance with the Russian Duke Constantine. The Russians murder the envoys. A Mughal army crushingly defeats the Russians at the Battle of the Kalka, 16 June, 1224. After this the Russian duchies become tributary to the Mughals.

1225. **England**—Freemen are exempted from bridge-building ; but the repairing of bridges is made compulsory on towns, shires and lordships. First protective Act for honey found in woods, this is declared the property of the freeman owning the wood. Great Charter of Henry III., confirming the terms arranged in the Convention of King John.

1226. **Baltic Provinces**—The Teutonic knights obtain some territory on the Vistula from Konrad, duke of Mazov, in return for their services in ravaging Pohlen ; but they are defeated in an attack on East Prussia, also done for him.

1226. **England**—Heraldic signs become more permanently

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hereditary. Weddings are now first celebrated in churches under Papal order of 1199.

1227. **England**—Papal tithes for Church livings are now first forcibly collected, by decree of Pope Gregory IX. Strong opposition is made. The privileges of the Barons are again reduced.

1227. **Germany**—German Crusade of Emperor Frederic II.; he sails from Brundisium with 40 000 men and is forced to return—for this he is excommunicated. In 1228 he arrives at Jerusalem without opposition, and is again excommunicated. He obtains in 1229, by diplomatic means, a treaty ceding Jerusalem, Bethlehem, Nazareth, Tyre and Sidon, with right to fortify; also free passage for pilgrims. Peace is maintained for nine years afterwards.

1229. **England**—Arrival of Lombard usurers in London; they replace the Jews to some extent, and are chiefly money-lenders and pawnbrokers. At this time pawnbroking was uncontrolled.

1229. **France**—Raymond VIII. of Toulouse is scourged by priests at Nôtre Dame de Paris in April, and his possessions are taken by Louis IX. the Saint. *See* 1206.

1230. **Germany**—The Emperor Frederic II. emancipates all serfs on the imperial estates; after this event the gradual emancipation of all serfs in Germany takes place. *See* 1223, 1201.

1231. **Bohemia**—Successes in Moravia against the Austrians.

1231. **Europe**—Rise of the cultivation of science, following the translation of Ptolemy's 'Almagest' from Arabic into Latin.

1232. **Germany**—The Emperor Frederic receives a clock as a present from Salтан Salahuddin of Egypt.

1233. **England**—Copper mines are now known at Keswick, Newlands, and Goldscope (Close rolls of Henry III.). The miners of Alderston or Alston Moor, Cumberland, who worked for lead and silver, now are granted Royal protection. *See* 1153.

1233. **Papedom**—The powers of Inquisition of the Holy Office, established in 1204, are now entrusted to the Dominicans, by Pope Honorius III. The Dominicans had held moderate views (*see* 1140), and had already entered England in 1221.

1233. **Baltic Provinces**—The Teutonic knights, who acquired some territory in 1230 in Prussia from the King of Pohlen in return for service in Prussia, now attack Duke Mestwin in East Pommern, and attack the pagan Borussi in Prussia. The struggle begins with the battle of the Sirguna won by Herman; and continues for fifty years until 1283, when the Teutonic knights complete the conquest of Prussia, and acknowledge the sovereignty of Pohlen. In Lithuania the Livonian knights are opposed by Grand Duke Ringold, who unites the Lithuanian tribes in 1280, and defeats the knights in 1283.

1233. **Italy**—The Inquisitor-General, Peter of Verona, persecutes the Poor Men of Lyons, the Believers of Milan, the Brethren, the Band of Love, and the Followers of Purity, in North Italy for nineteen years.

1234. **England**—Coal is discovered in large quantities near

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Newcastle. Cider is made from apples (it seems that the word "cider" also applied to distilled spirits).

1234. **Germany**—Rise of the popular notions about witchcraft in Germany, which are maintained till 1749 at Wurzburg; it is remarkable that evidence and proof was always forthcoming. These notions were also in vogue in Italy and in England. The Stedingers of Oldenburg, a branch of the Halleans, that rose c. 1130 from the Arnoldists, and refused tithes to the Pope, are now exterminated by Papal decree, under Emperor Frederic II.

1235. **England**—Expulsion of the Causini from London by Bishop Roger; they were not only money-lenders and usurers, but they collected and perhaps farmed the Papal tithes; they obtain Papal protection and return. A commercial company, termed the Steelyard Company, of foreign traders acting through English agents, obtains special privileges. *See* 1215.

1235. **Italy**—Decree of the Emperor Frederic II. that men ignorant of anatomy shall not be allowed to practise surgery (many of the anatomists were Sicilians). Medical edict establishing druggists (many of these were Neapolitan Greeks).

1236. **England**—Re-introduction of leaden water-pipes; used in Roman times. The nobles declare adherence to the Common Law, or Code of Edward, confirmed by William I. on accession.

1236. **Spain**—First conquest of Granada. Fall of the Almuwahād.

1236. **Mughals**—Reconquest of the Russian duchies. Raid in Pohlen, Hungary, and Bessarabia.

1236. **Latin Princedoms**—The Moslems destroy Bethlehem after a successful attack. *See* 1227.

1237. **Pohlen**—Salt-works are formed at Welicska.

1238. **Denmark**—General survey made by order of Waldemar II. A code of law for the whole kingdom, termed "the Jutland Laws," is drawn up. Livonia and Revel are acquired under a restoration. *See* 1220.

1238. **England**—Silver mines are now worked in the county of Durham; and perhaps long before. *See* 1233.

1238. **Latin Princedoms**—Jerusalem is taken by the Moslems. Crusade of Thibaut of Navarra begins.

1239. **England**—Charter of Henry III. allowing digging for coal at Newcastle; apparently this is a grant of Right of Search. *See* 1201, 1234, and 1215.

1239. **Italy**—A series of Imperial disasters now begins. Papal war of Gregory IX. against Frederic II. Rise of painting.

1239. **Mughals**—Conquest of Volhynia, Gallicia, and Pohlen.

1240. **Bohemia**—Tin is discovered in Bohemia, perhaps also in Saxony; hitherto it was supplied from Cornwall.

1240. **Provence**—Early case of a temporary republic in Provence, in the separated county of Arles.

1240. **Mughals**—Discovery of Siberia by Mughals from Kipchak. Conquest of Wallachia, occupation for 50 years.

Record of Progress

1241. **England**—Hanging is introduced, also drawing and quartering. The Maiden, or Widow, a guillotine, is used in this century at Halifax. Election of town aldermen, sheriffs or bailiffs, by folk-motes of freehold townsmen; hitherto the reeve was a nobleman appointed by the king, or was hereditary.

1241. **Germany**—The Hanse towns are now fully established.

1241. **Bohemia**—Mughal invasion. Battle of Olmutz. Battle of Neustadt. Battle of Wahlstatt. Defeat of Bedu Khan; who next conquers Hungary and Dalmatia, and retires in 1242.

1241. **Latin Princedoms**—Richard of Cornwall ransoms Jerusalem.

1242. **Mughals**—Building of Sarai. Settlement in Siberia.

1243. **England**—Linen making is revived in Wiltshire and Sussex. It had been an ancient British and præ-Roman manufacture. It had also been a large local industry of the Anglo-Saxons in the sixth century, but had passed to Ireland and perhaps to Wales in the eleventh century.

1244. **Latin Princedoms**—The Khwarazmi pillage Syria, massacre 70 000 Christians at Rama, and sack Jerusalem. Battle of Carita, 18 and 19 October; defeat of Walter de Brienne and Amir Bibars; slaughter of 30 000 Christians. Siege of Jaffa, November. Blockade of Damascus. These Khwarazmi are expelled from Syria by the Egyptians in 1247.

1245. **Europe**—Thirteenth Council at Lyons. Decree releasing every one from allegiance to Emperor Frederic II.

1245. **England**—Bills of exchange are now first known. Earliest use of Newcastle coal in London factories. *See* 1234.

1245. **Hungary**—Famine and plague of locusts, after a fresh Mughal invasion; human flesh is sold for food. Under the efforts of King Bela IV. the country is restored to a better state in five years.

1245. **Portugal**—The government now consists of the favourites of women of the Court. Revolt of the people.

1246. **England**—Order that London houses shall be covered with roofs of slate or of tile.

1247. **England**—Early gold coinage. Gold pennies are made, equal to two silver pennies in weight, and equal to twenty in value; their fineness was 24 carats, or pure gold, and their weight 22½ grains. The older coins were the Byzant (ten shillings) of Constantinople, and the Florence of the same value coined at Florence.

1247. **Germany**—Signature of the Hanseatic League. *See* 1241. The Hansards had already carried on commercial matters in Germany before this. *See* 1140. But this is a large League.

1247. **Popedom**—Papal attempt to depose the Emp. Frederic II.; the Papal or Guelfic party elect Henry Raspon of Thuringia as rival emperor, and the Guelfic towns follow Milan as leader.

1248. **France**—French crusade in Egypt by Louis IX.; begins in 1248; Damiad is taken, June 1249; Battle of Mansurah, 5 April, 1250; Louis is defeated and imprisoned; the French are destroyed. Damiad surrenders.

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1248. **Castilla**—Fernando III. founds the leper asylum of Sevilla.

1249. **Netherlands**—Formation of the first Binnenhof, or Court of Holland, at the Hague ; a village (probably a haugh, or burial-mound) near the hunting seat of the count.

1250. **Baltic Provinces**—The Teutonic knights again acquire Livonia by cession from Denmark. The Knights of Jerusalem and of the Sword enter Lithuania and form settlements ; they baptize Duke Mindvog in 1252, but the Letts remain idolaters.

1250. **England**—The Hansards establish a foreign factory (trade depôt) in London. *See* 1247, 1241.

1250. **Germany**—Death of Emperor Frederic II. Subsequent emperors possess little power till 1273.

1250. **Italy**—Battle of Parma won by the Papal party. The rise of lordships of the towns of North Italy follows this imperial defeat, and the death of Frederic II.

1250. **Spain**—The fraternity of La Santa Hermandad is formed in Aragon ; it is the first protective police establishment on a voluntary basis.

1251. **England**—The Causini usurers are prosecuted in the Civil Courts ; they are punished, but are enabled through bribery to renew their practices.

1252. **Italy**—Peter of Verona, Inquisitor-General, is assassinated after nineteen years of tyranny. *See* 1233, 1204.

1252. **England**—Roger Bacon invents convex magnifying glasses, and the magic lantern. He raises acoustics to a science by his investigations. He knows the basic operations of chemistry, and is a good mechanic. He knows the constituents of gunpowder (probably sent to him from Spain), and first mentions saltpetre, hitherto unknown in England. He makes a speaking-head, or Eolipile, an ancient Egyptian device. He had studied the optics of Euclid and of Ptolemy.—Letters on public matters are conveyed by royal messengers (cokinus, garcio, or nuncius) under the old Roman and ancient English system. Couriers, or angels, carrying on *anguria*, were persons performing local service for their thanes with horse or with waggon. Such service was very unpopular ; these angels and the bakers (usually thieves) were the lowest of the population. In France it was not better. Western Europe was inferior to Asia in postal arrangements.

1252. **Flanders**—Cotton clothes are now known in Flanders, as well as in Europe generally ; but they are of Oriental, perhaps Persian, manufacture. English and Flemish linen was usually worn.

1252. **France**—Louis IX. the Saint restores Aquitaine to England from a sense of honour ; but the territories seized and obtained in various ways since the period of the intrigue with Arthur against King John were these—Normandy in 1203 ; parts of Guienne in 1203 ; Poitou, 1214 ; attempt on England, 1215 ; parts of Guienne, Perigord, and Limousin in 1224 ; Bretagne, 1236. It was, however, a rare deed for a Frenchman.

1253. **England**—Night watches are established in towns and

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boroughs according to the use of Savoy; compensation for losses and robberies is to be paid. (This is a very old Indian custom in both respects.)

1253. **Germany**—Formation of the Rhine Navigation League against tolls.

1253. **Spain**—Alphonso, king of Castilla, makes astronomical tables; probably some of this was worked out by Moors of Toledo or Arabs. The rearing of silkworms is introduced, probably from Sicily.

1254. **Bohemia**—Occupation of Austria under claim.

1254. **Popedom**—Compulsory auricular confession is decreed by Pope Alexander IV. *See* 1215.

1255. **Bohemia**—Przemislav II., king of Bohemia, attacks the pagan Prussians, and founds Königsberg and other towns. He also purchases Styria, Krain, and Istria. *See* 1262.

1255. **England**—Sir William Crane introduces tapestry. Princess Eleanor, of Castilla, wife of Prince Edward, introduces carpets; this custom incurs ridicule—the old method was a clean floor strewn with rushes or with sand.

1255. **Mughals**—Death of the conqueror Bedu Khan, ruler of Kipchak, Russia, &c. He is succeeded by Berkai Khan, either as regent for Sartakh, or as heir.

1256. **Germany**—Public beheading is still the customary punishment for female infidelity; it is done at Donauwerth, in Bavaria.

1257. **Denmark**—A rebellion is headed by priests and bishops, who obtain a Papal interdict, and eventually poison the King. The rebellion and interdict last till 1274.

1257. **England**—Standard measures are established, and gold pennies are issued. *See* 1247. Difficulties about Papal tithes.

1258. **England**—Proceedings of the Mad Parliament of Oxford. Henry, who is deposed, is forced to sell his rights in Le Maine, Normandy, Anjou, Touraine, and Poitou, to Louis IX. The tumbrel is the punishment for fraudulent bakers. Committee for Parliamentary reform.

1258. **Spain**—The Christian Era is now used instead of the Spanish Era of Augustan Conquest. 1 January, 38 B.C.

1258. **Italy**—War between Venice and Genoa till 1286.

1259. **England**—The Hansards or Hanseatic merchants of London obtain special privileges. *See* 1250.

1259. **Mughals**—Second conquest of Pohlen.

1259. **China**—Explosive shells are now used in war; rockets and cannon were ancient.

1260. **Spain**—All public records are now made in Spanish instead of in Latin.

1260. **Kipchak**—The independence of the rulers of Kipchak and Russia begins this year under Berkai Khan, hitherto vassal of the Great Kañ of the Mughals.

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1260. **Latin Princedoms**—Sultan Bibars of Egypt takes Jerusalem.

1260. **Iceland**—The Republic becomes tributary to Hako VI. of Norway, and the constitution is soon destroyed.

1261. **Kipchak**—Churches are built at Sarai, and a bishop is appointed. The Mughals and the Great Kāans had been Nestorian Christians, and observed Easter ceremonies.

1261. **Greek Empire**—The Cumans and Greeks under Alexius surprise Constantinople 25 July. Baldwin II. escapes. Close of the Latin Empire of Constantinople.

1262. **England**—Outbreak against the Jews from their ruining families by heavy usury charges. Seven hundred are killed. But a legal interest is not yet forced, and State intervention in matters of unjust charge is not arranged.

1263. **England**—The people of the Hebrides ask for Norwegian protection against the oppression of Alexander III., vassal king of Scotland. The troops of Hako V. ravage the land, but his fleet is destroyed by a storm.

1264. **England**—The national flag of Henry III. is still the Dragon of Wessex. The commons are first summoned to Parliament before the close of the Baronial war.

1264. **Italy**—Passion-plays are acted at Rome; these are spectacles of Gospel narrative, and not miracula descriptive of legendary saints. *See* 1420.

1265. **England**—Death of the Earl of Leicester, chief of the Baronial forces, and founder of English liberty.

1265. **Kipchak**—Founding of the town Kazan.

1266. **England**—Murage grant to the town Lewes of levies on all iron passing through it; hence there were then iron works in Sussex. The Hansards obtain a monopoly of commercial privileges. *See* 1259, 1250. The current prices of bread and ale are now fixed in accordance with the price of corn. Invasion of Magnus VI. of Norway, he cedes the Hebrides and Shetlands in fief.

1266. **Italy**—Rise of the mercantile guilds and craft guilds, *arti majori e minori*, of Florence.

1267. **England**—Beginning of the imprisonment of Bacon for ten years, on charges of crime. He sends his 'Opus Majus' to the Pope Clement IV. Statute of pillory and tumbrel affecting fraudulent bakers and brewers.

1267. **France**—Police are instituted in Paris; tower watchmen and night watchmen had existed for long. *See* 1250.

1268. **South Italy**—Charles of Anjou and Provence, brother of Louis IX. of France, becomes king of Naples and Sicily, after killing Konradin, 29 October.

1268. **Latin Princedoms**—Sultan Bibars of Egypt takes and destroys Antioch 12 June, and massacres his captives. Some Christian fugitives settle in Cyprus. *See* also 1260 and 1261. Others return, *see* 1291.

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1269. **England**—The plays termed "Mysteries of Chester" are now performed in churches by priests, monks and chorister boys. Jews are forbidden to own freeholds in England.

1269. **France**—Pragmatic Sanction and defence of the Gallican Church. Tunisian Crusade is prepared in 1269. Unsuccessful attack on Tunis; and retreat of the French, with the help of Charles of Sicily, after suffering much from plague.

1269. **South Italy**—The Queen of Charles of Anjou enters Naples in an ornamental *caretta*; this was a hooded cart on two wheels drawn by one horse in shafts, ridden by a postilion.

1270. **England**—Reputed date of the adoption of linen-made paper. *See* 1248. Rebellion in Ireland followed by the massacre of some English inhabitants.

1270. **France**—Date of the earliest French documents of linen paper (Montfaucon). A Scottish guard is embodied for the protection of the Court of Philippe III.

1270. **Italy**—Theodoric uses anæsthetic fumes in surgical cases; an Indian invention. Researches in optics by Vitello.

1271. **England**—English Crusade of Prince Edward, son of Henry III.; he takes Accho in April, and Nazareth in May; and in 1272 obtains treaty of peace for ten years, and free passage for Christian pilgrims. Waldemar of Sweden joins the crusade.

1271. **France**—The College of Surgeons of Paris is established.

1272. **Kipchak**—Reconquest of Hungary, by a series of irruptions from 1272 to 1290. Beginning of conversion to Islam among the Mughals.

1273. **Germany**—Rodolf of Habsburg becomes Emperor; and restores unity in sixteen years. He obtains or holds some limited power of appointing priests, termed "First Prayers." Decline of Minnesingers. *See* 1197 and 1207. The Meistersingers replace them as incorporated bodies, first at Metz, then at Augsburg, Nurnberg, Strassburg, &c.

1273. **Italy**—Gilding with bole ammoniac is practised by Margaritone; but the ancient Græco-Roman process of gilding is a lost art. Poisoned weapons are used at Bologna.

1274. **Denmark**—A large payment is made to the Primate for reconciliation with the clergy.

1274. **England**—First commercial treaty of Edward I. with Flanders. Export and import dues are granted by Parliament (apparently not on Hanseatic commerce). Jewish usurers wear distinctive badges, afterwards there is further protection.

1274. **Bohemia**—Rodolf of Habsburg recovers Austria, Karinthia, Styria, and Istria.

1274. **Europe**—Fourteenth Council at Lyons—Union of the Greek Church; interdict on Denmark removed.

1274. **Italy**—Death of Thomas Aquinas, writer on Ethics and on ecclesiastical subjects.

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1275. **Popedom**—Papal refusal to acknowledge King Jayme of Aragon at a Council, because he does not pay tithe.

1275. **Lithuania**—Duke Guerimond unites Samogitia to his territory, and wars against Pohlen.

1275. **France**—Pierre de la Brosse is hanged for treason and libel. *See* 1241; it is supposed that modern hanging was of French origin, and was practised before 1241.

1275. **Kipchak**—The poll tax on the Russian duchies, hitherto farmed out to Khivan merchants, is now collected by the Russian dukes. The Russians join the Mughals in attacking the Caucasus, and they sack Dediakof, the capital of the Jassies in Daghestan for Mangu Khan.

1276. **Spain**—Alfonso X. of Castilla makes a treaty with the Amir of Marocco.

1277. **England**—Monumental brasses, perhaps of Flemish introduction, are now made.

1278. **Lithuania**—Separation of Samogitia under Tribus, on the accession of Giligin.

1278. **Germany**—The Hansards have now four foreign factories; at London, Bruges, Bergen, and Novgorod. *See* 1250, 1266.

1279. **England**—Edward I. does homage to Philippe III. for the territories owned beyond the Channel. A knowledge of perspective is introduced by John Peckham, archbishop of Canterbury; apparently he is the earliest writer on the subject. A Mortmain Act is passed to prevent the clergy from acquiring all the land by gift, bequest, and purchase. First central authority over all the mints is established.

1280. **Norway**—Priests now lose their immunities wrung from past kings; they cease to be treated as nobles, and become amenable to civil tribunals.

1280. **England**—Royal Charter to the Hansards. *See* 1259, 1266. Enquiry into official tenures.

1280. **Germany**—Death of Albertus Magnus, author of 'De Mirabilibus Mundi,' at Köln.

1280. **Spain**—Guns, perhaps culverins, are used at the attack on Cordova; mortars are well known, but they were chiefly rock-mortars throwing stone shot. *See* 1118, 1182, 1156.

1280. **Kipchak**—Conquest of Bulgaria and occupation for twenty years or more.

1281. **England**—A cheque is drawn on Bourunonio de Luk in favour of Robert de Brus, by King Edward I. on 10 September, 1281. Wolves are still numerous and formidable in England.

1282. **Greek Empire**—Pope Martin excommunicates the Emperor Michael III. for insufficient zeal in four years of brutal efforts to enforce conformity. The Greek Union of 1277 is dissolved.

1282. **Sicily**—Charles of Anjou and all his French and Provençals are killed at the Sicilian Vespers, or revolt, 30 March, probably in revenge for the murder of Konradin :—Pedro III. of Aragon enters at Sicilian invitation, and founds a dynasty.

Record of Progress

1283. **Baltic Provinces**—The Teutonic knights in Prussia attempt to throw off allegiance to Pohlen, after completing the conquest ; but they submit later.

1283. **England**—Pictorial painting on panel with oil is known, as shown by the records of the Painters' Company (Palgrave). Seizure of chattels for debt is now first allowed.

1283. **Spain**—Papal excommunication of King Pedro III. of Aragon by Pope Martin V.

1284. **England**—Supposed date of the record of Bacon, mentioning the composition of gunpowder.

1284. **Aragon**—Roger de Lauria defeats the French at sea.

1285. **England**—Improved water supply to London by several conduits ; perhaps a few iron water-pipes were made at this time. *See* 1236. Twelve candidates for the crown of Scotland request arbitration of the King of England. Highways between market towns are widened. London brokers are now registered. Entailing estates is adopted as a protection against royal or other seizure and confiscation, or assignment to clergy.

1285. **Italy**—The kingdom of Naples (without Sicily) is inherited by Charles II. of Provence and Anjou.

1286. **England**—Silk mantles are now worn, probably of Venetian admittance.

1287. **Denmark**—The Norwegians support the Count of Holland, and war for twenty-one years against Denmark.

1287. **England**—General arrest of Jews ; fifteen thousand are banished from England.

1287. **Bohemia**—Acquisitions in Misnia and Eger. Bohemia becomes an electorate of the Empire.

1287. **Kipchak**—Invasion of Pohlen ; and devastation.

1288. **England**—A clock for Westminster Hall is made at the expense of a fine levied on the Chief Justice Ranulf Higden ; it remained there for 200 years.

1289. **Germany**—The Thuringian castles are dismantled.

1289. **Pohlen**—Invasion and general ravage by Lithuanians, Prussians, and Bohemians. Also again by Mughals from Kipchak ; who enter in 1289 and in 1290 ; and withdraw entirely.

1289. **Wallachia**—This country becomes a separate kingdom about this time.

1290. **Kipchak**—The Mughals withdraw entirely from Pohlen proper, and Hungary proper. Hungary had been ravaged in 1277, and again about 1285-90.

1299. **Sweden**—The regent Thorkill subdues the Finns, the Carelians and the Ingrians.

1290. **England**—All Jews are banished, including those of Cornwall, who had oppressed the miners. *See* 1287. Tallow candles are introduced. Petition of London townsmen for the expulsion of alien merchants. *See* 1280, 1266, 1259. New English translation of the Christian Scriptures ; also of the Jewish books.

1290. **Bohemia**—The Jews of Prague are attacked.

Record of Progress

1290. **Italy**—The harbour of Porto Pisano is ruined by the Genoese, who sink ships at the entrance. Invention of the bleeding "hostia," a pretended miracle that was believed.

1291. **Greek Empire**—The use of the ancient Greek fire of Kallinikos is continued till now: probably also the force-pump for shooting the liquid.

1291. **Latin Princedoms**—The Mamluks under Sultan Khalil take Accho 18 May; they seize Tyre, but Sidon is abandoned; the fugitives settle in Cyprus. Close of all Syrian Princedoms.

1292. **England**—A large new striking clock (orologium) costing thirty pounds is made for the cathedral church of Canterbury: probably the Paduan method of 24 equal hours is now in vogue; formerly it was different by day and by night.

1293. **Kipchak**—The Mughals of Wallachia and of Kipchak ravage Dalmatia, &c., again.

1294. **England**—Silver mines are discovered in Devon. Death of Bacon, who had been released c. 1292.

1295. **Denmark**—Eric VIII. is excommunicated and fined 40 000 marks by a council of Cardinals for imprisoning a rebellious bishop.

1295. **England**—The Scottish public records are lost at sea. Division of Ireland into counties and baronies.

1295. **Pohlen**—King Przemislas restores peace, and acquires East Pommern on the death of Mestwin II.

1296. **England**—Baliol renounces homage. The Cumberland Border service is instituted under Clifford. Battle of Dunbar—Baliol is deposed.

1297. **England**—Taxation now requires Parliamentary consent, and the national funds are hampered. Scottish rebellion under Wallace (1297) subdued after Battle of Falkirk, July, 1298.

1297. **Bohemia**—Pictorial painting in oil is known to Thomas de Muttina, or Muttersdorf, whose picture long existed in the Vienna gallery. *See* 1283.

1297. **Italy**—Dissection at Bologna is forbidden by Pope Boniface VIII. *See* 1139 and 1235. Probably Mondino at Bologna was beginning to dissect at this time. *See* also 1316.

1298. **England**—Some improvements are made in connection with windmills. *See* 1040. The Scottish succession is referred to Papal arbitration.

1299. **Italy**—Spina, a monk of Pisa, improves spectacles, which had been invented by Salvino degli Armati, who lived at Florence. (For convex lenses, *see* 1252.)

DISCOVERY IN SPECIAL BRANCHES.

Archaic Discovery.

1281, c. The *Almagest* of Ptolemy in Arabic.

Naturalistic Notes.

1281. The wolf is formidable in numbers in England.

1292. The companions of Marco Polo see the great roc (*Euphoris maximus*) during their visit to Makdashbu on the Somali coast. It is supposed that it became extinct soon after this. (Eggs and bones have been found in Madagascar.)

Chemical Separations, &c.

1284-1315. Nitric acid, separated through adding vitriol, by Vincent Bellovacensis.

1266, c. Again, by Raimundo Lullo.

(It was known as a secret by Theophilus in the twelfth century.)

1266, c. Ether, known as an anæsthetic to Raimundo Lullo.

1270. Anæsthetic fumes, known to Theodoric.

Exploration and Settlement.

1202. Travels of Leonardo Bonacci, Pisan, in Tatar, Armenia, Bugia, and Syria between 1202 and 1220.

1245-47. Gian di Piano Carpin, of Perugia, with Stephen, a Bohemian, in April 1245 go to Kiev Kaniev, on the Dnieper, and the Court of Baidu. Thence into Turkistan to Kara Khatu and Zaman, to Syra-Orda, Karakuram, the Court of Mangu, the Kañ, 22 July, 1246. Thence to the Court of Baidu and to Kiev, June 1247.

1253-54. William Ruysbroeck, of Brabant, 1230, & 1294, and others go to the mouth of the Don, and by Azov, to the camp of Sartakh, on the Volga. Thence to the Court of Baidu. From the Court of Baidu to Kenchat, Talach, and the Uxiartes to Equius. Thence by Organum to Kara Koram, in 1253. From Kara Koram to the north of the mountains to a palace of Mangu, near the mines of Bokol, where German and French captives made arms and worked the mines. From Bokol to Kara Koram, thence to Astrakhan, and through Syria homeward.

1260-69. Nicolas and Matteo Polo went from Krim to the camp of Barkai Khan, on the Volga, for a year; thence to Bokhara for three years; thence to the Court of Kublai (in Mongolia); and thence nearly three years going to Armenia and to Accho.

1271-76. Second voyage of the two Polos, with Marco, a son, from Laia (Issus) to Armenia and Georgia, to Mosul, Baghdad. Thence to Tauris in Azyrbijan, and Yezd, to Kirman, and Koman, and Ormuz. From Ormuz to Korman, Khabis, and Tonakan, to Cheburgan, in Khurasan. Thence to Balh Taikan and Kasem, and to Kashmir. Thence to Vakan and Kashgar. From Kashgar to Samarkand, Yarkand, Khoten, Pein, Karachar, Lob. Crossing the desert in a year to Tatsiu, in Tangut, to Amil, Giuchiutalas, back to Tatsiu. From Tatsiu to Kantsin and Etsina to Kara Koram (?), back to Kantsiu, and to Erginul and Sinlingfu. Back

Discovery in Special Branches

to Erginul, and to Chalis and Tenduc, Sundachu, and Chaganur, and Chandu, which was the palace of Kublai Khan. Marco lived afterwards at Kambhayat, and was sent on missions by Kublai Khan.

1280-90. Travels in China. Mission of Marco Polo from Kambhayat (Peking) into Shansi and Shensi provinces, into Sze-tchuen, and Eastern Thibet. Through Gendu and Tsimung, to Karajan (Yunnan) and Zardandan provinces, to the town Bhamo, to Mien (Burma) and Bangala, to Kansigu. From Kansigu, by Amu and Anam, to Toloman, to Gigi and Sindifu, in Tsechnen, back to Kublai Khan.

Second mission from Kublai Khan to Changli and Kandinfu, in Shantung. Thence to Lin Hing and Sigi, and Cingi to Karamoran, into the province Mangi. Onward to Koigangi, Pao-in-chen and Kaoyu, Taichu and Yangui (also called Yang-tchu), of which Marco was governor for three years. From Yangui Marco Polo made several expeditions into Southern China.

1291-93. Sea voyage of the three Polos, from Zaitem to Champu (Ngannan) and Java, to Condor and

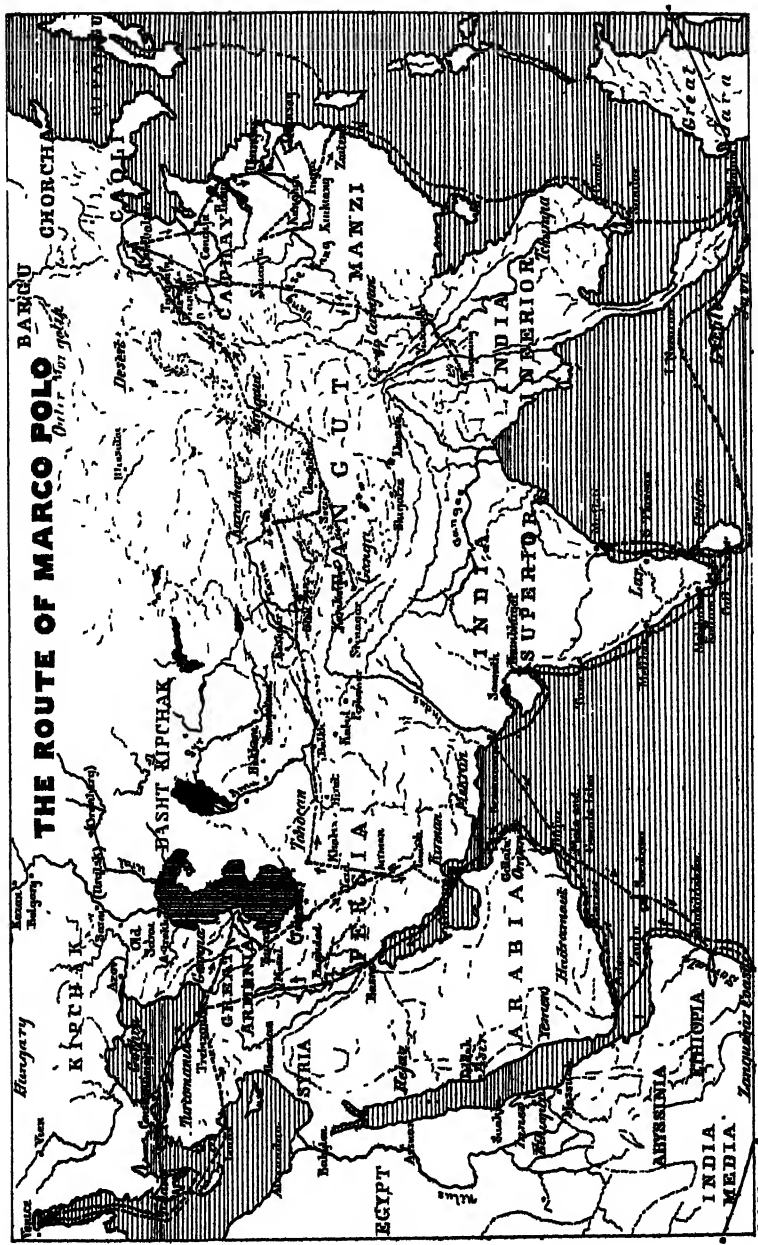
Sandur (Cochin China), to Bantam Island and Little Java (Sumatra). Thence to Mekran and to Ceylon. From Ceylon to the Maabar pearl-fisheries and Muftuli, to S. Thomas, back to Maabar, Lar, and Ceylon. From Ceylon to Kel, and Kollam, and Mandala; to Tana, Kanetrayat, Somnath, Kesmakoram (Mekram); to Omān. From Omān to Socotra and Makdashbu, and to the Zanzibar coast and Abyssinia; to Zaila and Aden, Eskiah, Dabar, and Galata; to the end of the voyage Ormuz, whence, by Trebizond and Negropont, to Venice.

1285. Travels of Athalbrand and Thorwald from Iceland; they discover some new lands, part of North America.

1290. King Eirik III., the Priest-hater, of Norway, sends Hrolfr the discoverer to find the lands discovered in 1285 in America.

1292, c. Visit of John Montecorvino, Papal legate, to Kublai Khan. He resides at Kambhayat for forty years, and dies there in 1328.

1296, c. Visit of Fra Oderico de Pordennone to Canton and Peking, for thirteen years.



FOURTEENTH CENTURY

1300 TO 1399.

PERIOD OF THE ANGLO-FRENCH WARS.

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FOURTEENTH CENTURY

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PERIOD OF THE ANGLO-FRENCH WARS.

GENERAL DEVELOPMENT.

THE political condition of Europe will be treated in another section, where the isolation and the unsettled state will be shown in detail to be unfavourable.

The financial state of almost every country was almost as bad. Taking England as an example; there were neither national funds, nor any finance on a firm basis that served for carrying out national undertakings or public affairs. The fyrd, or militia, was called out with little, if any, financial support in 1323, though the Commission of Array was issued from the Exchequer; thus the Scots and the English rebellious barons, together with the French or Queen's party, were able to overthrow the power of the State. A Parliamentary grant of 30 000 sacks of wool was quite an unusual thing, though granted in 1339. An attempt to raise money by tonnage and poundage in 1348 and in 1381 was fruitless; while in 1377 the Commons of Parliament obtain the right of controlling supply and scrutinising treasury accounts of very small national income. The King had to pawn the Regalia in 1338 to be able to support his just claims in France. Sometimes money was raised by aids or benevolences, virtually free or charitable gifts; public loans were not raised till the attempt of 1382, when Richard II. in vain tried to raise £40 000 as a loan from the merchants. The barons and commanders could not carry on war beyond sea without funds. Public affairs were chiefly matters of private enterprise.

The French, with their greater thriftiness and less dissension, were in a state very little better. In Pohlen the people and

nobles did not support the State with funds, but sought for and crowned as kings nobles of wealth and influence of other countries, who would support the State from their own means. The Mughals raised their funds by annual poll-tax, and to some extent by plunder in ravaging revolted territories. The Popedom, supported by all Christians of the Latin Church, was in a sad financial state, and had recourse to strange devices. The reversions of all Italian ecclesiastical benefices were valued by agents, and put up for sale in 1389; while something similar had been attempted in England, as the Act of 1383, declaring aliens ineligible to any English benefice, even through purchase, was directed against it; and this was followed in 1390 by the Parliamentary abolition of Papal power in England. There were also earlier attempts of the Popedom to raise money in England, as the following records show. In 1307 Pope Clement V. claimed the disposal of English benefices and of their reversions, termed provisions, and the claim was strongly resisted. In 1344, the Statute of *Præmunire* excluded aliens from English benefices; and soon after, in 1350, the Statute of *Provisors* was issued, making penal the offence of procuring an English benefice from the Pope, and forbidding appeal to him in such matters; a statute doubtless due to some cause similar to that in Italy in 1389. In 1363 the Parliament rejected the Papal demand for tithes. In 1370 King Edward III. acting under advice, refused to pay tribute to the Pope, and to act up to the concessions formerly wrung out of King John. If such matters are evidence of persistent Papal greed displayed from time to time, they equally indicate the financial difficulties that may have led to them or followed them.

The international commerce of Europe on a large scale was begun and developed to a great extent in this century; but it was kept in the hands of a gigantic commercial association as a monopoly that steadily drained Europe, acquiring enormous wealth and power. The Hanseatic League, which was strong in 1259 and in 1280, when it obtained its English privileges and its charter, was joined by the Flemings at Bruges and elsewhere in the Netherlands in 1300; but in 1370 it controlled the commerce of 108 towns, chiefly German and Flemish, besides those in England. It could both fix prices of commodities, under charters of privileges it had acquired, and afterwards could control monarchs, and alter the destinies of kingdoms and states. It could raise money by raising prices, though monarchs failed to raise it by tonnage and poundage;

and it could further its objects by supporting monarchs. The Jews of past times had ruined nobles and individuals singly; the Hansards were ruining nations. Sweden was impoverished by them in 1319. In England the five staple commodities were reserved in sixteen staple towns for Merchants of the Staple, first in 1319, then in 1353; some similar small reserves existed on the Continent. At one time the export of corn, at another that of wool was forbidden. The Lombards replaced the Jews as money-lenders, but the legal rate of interest was as high as 20 per cent., equal to that in China in the nineteenth century. In Italy in 1377 there were small banking houses, and probably those of the Lombards everywhere resembled them.

Science hardly was known in its present sense. Astronomy was still nearly astrology; Chaucer explains the use of the astrolabe and little more to his son Lowis. Chemistry was yet little more than pretended transmutation of metals, and the earlier alchemy. Botany was not yet a science, though there were herbalists and druggists; and two Physic gardens were started, one at Salerno in 1309, the other at Venice in 1333; while there is merely a bare record of the few fruits and edible vegetables known in England in 1370, which were apparently the same as those in Germany, and were mostly of Roman introduction, or indigenous. Mathematics was primitive arithmetic, linear geometry, and optics. Geology was unknown, beyond the amount of mineralogy comprised in the knowledge of a few metalliferous and other ores. Anatomy was new, but was very soon stopped; the book of Mondini was perhaps the only result.

It is very remarkable that the leading scientists of Europe are few in this century; as far as record goes, they were these:—

Barleamo, Calabrian Greek—
mathematician, and teacher
of Greek . . . lived 1300 to 1348
Roberto di Bardi, Florentine
—natural and moral phi-
losopher *d.* 1349
Guy de Chauliac, Frenchman
—writer on surgery and
wounds *f.* 1350 to 1363
Jacopo Dondi, Paduan—as-
tronomical clockmaker *f.* 1320
to 1385
Nikephoros Gregoras, Greek,

of Heraklea—astronomer,
who observed comets . . . 1295 to
1360, *f.* 1337
Sir John Hawkwood (Giovanni
Acuto)—improver of mili-
tary tactics *d.* 1392
Ranulph Higden, English—cos-
mographer and historian *f.* 1360
Elissi di R. Mondino, Milan-
ese—anatomist and author.
f. 1316, *d.* 1326
John Tauler, lived at Strass-
burg—scientist *d.* 1360

Bernardo Trevisani, Venetian
—writer of a treatise on chemistry *f.* 1366

Arnold de Bachuone, of Villanova—chemist and physician in Aragon *d.* 1313

Moslem Scientists.

Ismail Abulfeda, prince of Hamāt—cosmographer and botanist, astronomer . . 1312 to 1345

Hamdallah Mustāfi, Khwāja, Persia—meteorologist, anatomist, naturalist, &c. . . *d.* 1349

Jallāl hakim—Persian physician *f.* 1353, 1384

Salṭān 'Alī—physician and author, Persian *f.* 1334

Takruddin (Makrizi), Egyptian—scientist, metallurgist, historian, &c. . . 1360 to 1442

Takiuddīn Sabakī—scientist; author of 150 books . . *d.* 1349

Zakkaria bin Muhammad, Kazzini—scientist and naturalist in many branches *f.* 1363

Education was much like that in the century before, it consisted chiefly in teaching Latin, and many more universities were founded for this purpose; but they were virtually ecclesiastical seminaries, aiming at supplying the priesthood locally instead of from abroad. The rise of English schools of law students occurred at this time; also the artistic academies of Italy and of France. The small circulating libraries of French towns were also new helps to the education of grown-up persons, as well as young students. Also the Brussels museum of 1346. The visit of some Greeks to Avignon led to the introduction of Greek and Greek literature in Southern Europe, as literary knowledge, which afterwards spread widely. The teachers of Greek were Barleamo, before-mentioned as a mathematician; Leontius Pilatos, b. Saloniki, who taught Greek literature at Florence, and flourished in 1343; and Emmanuel Chrysoloras, b. 1355 at Constantinople, who first taught at Florence in 1393, afterwards in other Italian towns, and died 1415.

Construction and Building, as far as regards town-building, and walling, castle-building, and church and abbey-building followed the same course as that of the last century; but in England there is a marked decline in the number of new abbeys, monasteries, and priories accompanying the Wickliffite Reformation, and consequent on the opinions that are mildly reflected in the writings of Chaucer. Among the novelties are the Town-hall of Bruges, founded in 1377, and the Town-hall of Retford, Notts, built in 1388. Among engineering works, besides a few stone bridges, there are a few special works, the Drainage-channels of the Pontine Marshes in 1303, the construction of Liverpool old Haven in 1332 to 1356, and the

Garonne Lighthouse, built by the English in 1370; the making of cannon and small firearms and the manufacture of gunpowder, both novelties, called for the skill of the craftsman and workman throughout Europe, though the early results were crude. New looms of various sorts followed the introduction of the Flemings into England. Lace-weaving and paper manufacture are developed. The water-driven saw-mill of Augsburg is one of the novelties of the century, also wire-drawing. The working of copper-mines and improvements in pottery and glass also entered into some new stages.

In the Fine Arts there is evidence of painting being known in Germany, as the record of the name of Wilhelm, a painter of Köln who flourished in 1380, shows; also of Nicholas Wurmser of Strassburg, who painted in oil in 1357. The two Flemish painters, Hubert and Jan van Eyck, may have begun to paint at the end of this century in 1394, though perhaps they did not flourish till the next. In Italy the fresco painters had become numerous, also the sculptors; among the former the two Orgagnas of Florence were the great developers and improvers; though they put poetical couplets coming out of the mouths of their figures of saints and others. In sculpture the three Pisanos developed work of a sort far superior to anything before them. But neither anatomical knowledge, nor even a knowledge of perspective, was yet brought to bear on Italian Fine Art. There are not yet any recorded names of Italian musical composers of this century. As to the troubadours, they were numerous, though none were of special note as in the last century; so too, the minnesingers and meistersingers, and minstrels in England. The poets of this century were, however, becoming less lyric than before, as the following list shows:—Dante Alighieri, 1265 to 1321; Lopez de Ayala, 1332 to 1407; Geoffrey Chaucer, 1328 to 1400; Cino da Pistoia, 1270 to 1337; Sir John Fastolf, 1377 to 1459; Jean Froissart, 1333 to 1410; Sir John Gower, 1320 to 1402; Robert Langlande, *fl.* 1340; Peter Langtoft, *fl.* 1307; Dante da Maiano, 14th cent.; Lawrence Minot, *fl.* 1352; Francesco Petrarca, 1304 to 1374; Antonio Pucci, 1333 to 1400; Lino Salutato, 1339 to 1406.

POLITICAL CONDITION.

The political condition of Europe was generally unfavourable to progress. There were not any external causes of disturbance, no serious Asiatic invasions of Europe. The Mughals of Kipchak had settled within territorial limits, and were content with their sovereignty over the Russian duchies, Volhynia and Podolia, Wallachia, Moldavia, and Bulgaria, besides the territories from the Pruth to the Volga; while the irruption of Timur was transient and brief. The Spanish Moslems of Granada were seldom left in peace by the Christians, but their aggressive powers had been limited. All aggression of the Christians of Europe in Syria had long ceased; the Latin Princedoms there had been evacuated, and the Lower or Later Greek Empire alone was invaded by Asiatics. It was a century of respite in all such matters, for the important Ottoman successes following the entry in 1357, began in 1389 with the Battle of Cossova and ended at the Battle of Angora in 1402, where Timur rendered valuable help to Europe.

The internal condition of Europe was turmoil throughout the century; the Anglo-French wars of succession disturbed England, Flanders, Burgundy, Navarra, as well as the provinces of divided allegiance, and set the Scots free to revolt and form an independent kingdom. The weakness of the German Empire, from the difficulties of the Guelfs and Ghibellines, set Italy relatively free, but divided into a number of states at constant war with each other. The rise of Swiss cantons in Transjuran Burgundy was due to the same cause, the weakness of the Empire. Pohlen recovered from the fearful devastation of the Mughals, but remained in a chronic state of disturbance till its union with Lithuania, near the close of the century. The continuous wars between Denmark and Sweden lasted till the union of Calmar at the very end of it. Hungary and Bohemia, much alike in political turmoil and varied successions, were seldom at rest for any long time. In no country was there permanent peace and settled succession together. Even in Kipchak, there was a short civil war 1363

to 1371, though Mughal rule was firm and Mughal succession was usually indisputable.

It is difficult to point out any one leading power in Europe between 1300 and 1346. Bohemia and France were both strong when England was weak; but from 1346 to 1435, for nearly ninety years, England was the leading power. It did not entirely regain the ascendancy formerly held in the twelfth century, which had grown naturally and without effort; for there was an opposing though illegal claim of the Valois to the English continental territories, but the supremacy was undoubted. Hungary was also strong under the Angevin dynasty from 1308 to 1389; it again included Croatia and Dalmatia; Servia, Wallachia, Moldavia, and Transsylvania were annexed in 1336; Bulgaria was reduced in 1336 and in 1342. The Neapolitans and Venetians were defeated in 1348 and 1358; Istria and Dalmatia were recovered, and a temporary dynastic union with Pohlen was formed in 1370 to 1382. Christian Spain showed extraordinary vigour during this century. The Moslems had defeated the Christians almost continuously from 1295 to 1333, though they had gained but little territory from them in that time. In 1333 the Spanish Moslems formed an alliance with the Moors of Marrākash, and attacked Castilla and Portugal. The resulting war, in which the Aragonese did not take any part, lasted for eleven years by land and sea, and consisted in a series of very hard-fought battles of alternating success; unparalleled in Spanish history for persistence and vigour on both sides, and perfectly independent of civil wars and succession difficulties. It was sheer hard fighting, and purely warlike; the result proved that Christian Spain could maintain itself against African attacks; though the acquisition merely of Algesiras at the end of the war showed only the acknowledgment of a small preponderance of power. From 1348 to 1399 peace was generally kept by the Spanish Moslem, whose future downfall now had become sure. His attacks were few, but his civil dissensions many. On the other hand Castilla and Leon could alone restrain him, while Aragon stood aloof. In fact, the Moslems could have been beaten out of Spain before 1399 if the unfortunate wars between Castilla and Portugal had not occurred, and lasted so long, 1369 to 1385 or later. The legitimate heir to the throne of Castilla was Fernando, king of Portugal, in opposition to the illegitimate Enrique of Trastamare, who with the help of Duguesclin murdered his father, Don Pedro I., in

1369. But Portugal was far weaker than Castilla, and the English intervened in 1382 and in 1385 to save it from Castilian annexation. Thus it was that the expulsion of the Moslem was deferred for a century.

The Mughals of Kipchak, conquerors in the past century, were losers in this, though their power was great. In 1300, Wallachia underwent a Walloon settlement, and Moldavia a settlement of Nogai; hence in both those countries the Mughals were in a minority and lost power. Transsylvania, Servia, and Bulgaria were occupied by the Hungarians in 1336, and never again became provinces of Kipchak. In 1339 to 1352 the Hungarians, Polacks, and Lithuanians occupied Volhynia and Podolia (Red Russia), which were thus lost to Kipchak.

In 1368 the Lithuanians not only occupied the territories on the lower Dneiper, but attacked Krim and Cherson. In 1386 the duchy of Kiev, apparently hitherto, certainly until 1321, a Russian duchy vassal to Kipchak, had become Lithuanian territory, and was annexed to Pohlen at the union. Thus the Kipchak sovereignty was reduced to the land now termed South Russia, and the Russian duchies, excluding Kiev. The Mughals had suffered from civil war in and after 1363, and never recovered from it; but the cause of their downfall was chiefly the attack of Timur's armies, and the rule of his nominee, from 1380 to 1395.

The intercourse between Europe and other parts of the world was less than that of the century before. The Mediterranean was not safe for European ships, from the Berber and Tunisian pirates; there was some commerce with the Levant, chiefly in the hands of the Genoese, Venetians and Greeks of the Lower Empire, and after 1347 the Venetians specially secured the Asiatic commerce that came by sea to Egypt. The Mughals of Kipchak had become comparatively isolated from Asia, when the main ruling stock of the Greak Kañs of Little Tibet went to rule in Cathay and China, and had ceased to be their suzerains in the century before, about 1260. Even the Siberian branch of the family had become independent. At no period had Europe been so entirely cut off from Africa and Asia.

Both introduction from without and progress within hence were greatly reduced by the political condition.

Purely religious war was yet in its infancy. The Apostolians under Fra Dolcino, maintained a short war in Italy from 1304 to 1307, and were suppressed. Pope Clemente V. excom-

municated the Venetians and humiliated Doge Giovanni Soranzo in 1310. But the Papacy was very weak from 1309 to 1447. Eighty Italian towns cast off the Papal yoke in 1375 and leagued against Gregory XI., this was political. In Germany the followers of Walter Lollard, who began his preaching in 1315, were not numerous and easily suppressed as heretics. In England the Wickliffites were not heretics in the main, but opposed priestly greed and domination as any good Catholic might do; they were also numerous, and obtained their object temporarily at least in 1390. In Pohlen the Jews obtained ascendancy through the influence of Esther, favourite of Casimir III. in 1356. Rienzi ruled Rome in 1347.

Civil war or serious rebellion existed in almost every country of Europe in some form, and was the great hindrance to progress; a Suabian league in Germany attempted to preserve peace.

Pestilence was frequent and virulent throughout Europe, also famine; the most marked cases were, the severe plague of 1315 in Germany, which began in other countries in 1314, and affected all England in 1316; an accompanying famine visited Germany in 1315 and England in 1318. The Great Œcumenical plague wasted all Europe in 1348, and in London was so severe as to kill 50 000 persons in one week; it had followed unusually wet weather, in England there had been persistent daily rain from Midsummer till Christmas. A year of very severe famine, termed the Dear Summer, followed the plague in England in 1353. In 1358 an extraordinary storm near Chartres killed 1000 men and horses of the English, and precipitated the peace of Brétigny, which was very unfavourable under the conditions, more specially as the Valois were then not popular even at Paris. The year 1381 was one of plague in Germany. In England 1389 was a year of famine, and 1390 was a year of severe pestilence in Northumbria. Italy and Southern Europe suffered more than Northern or Middle Europe from pestilence in the Great Plague of 1348-51; Venice suffered much in 1374, Milan in 1383 and in 1399, and to the Italians are due the first Sanitary Regulations of value, separation or going into camp, quarantine and disinfection of clothing. It may be noticed, however, that had good medical treatment and nursing been given in camp and in quarantine, the result would have been effective in curing and stopping the plague. The Italian method was originally one of neglect, and was due to fear alone.

RECORD OF PROGRESS AND EVENTS.

1300 TO 1399.

PERIOD OF THE ANGLO-FRENCH WARS.

1300. **England**—Tallow candles come into general use instead of oil lamps. *See* also in 1290. Chimneys are more generally adopted. *See* 1130. Military engineers exist.

1300. **Netherlands**—Windmills are now common; they were introduced from France or from England. *See* 1040, 1105, 1143. The Flemings of Bruges join the Hanseatic commercial league.

1300. **Italy**—The manufacture of pottery is revived at Pesaro under Boniface VIII.

1302. **Italy**—Improvement of the mariner's compass at Naples by Flavio and Gioja. The compass itself is by repute a Chinese invention; but the lodestone was known in ancient India.

1303. **France**—Early case of a packed jury. Philippe le Bel charges Pope Boniface VIII. with sorcery, and summons him before a Parisian council; the Pope dies from terror.

1304. **Italy**—Fra Dolcino heads the Apostolians, a Reformed sect, and maintains a defensive religious war for three years; his sectarians enter France and Germany as Reformers.

1305. **England**—Coal is brought in bulk from Newcastle to London (probably hitherto in small quantities only), a result of the discoveries of 1284.

1307. **England**—Bills of exchange are now commonly used; but they were adopted in 1245.

1308. **Italy**—The knowledge gained by the Asiatic traveller, Ser Marco Polo, the Venetian, is now circulated; he gives the earliest of the modern accounts about India, China, and Japan, &c., now long-forgotten countries.

1308. **Spain**—Guzman el Bueno uses gunpowder and guns at the siege of Gibraltar; probably this was the first use of both by European Christians; and they had been introduced newly by Muhammad II. king of Granada. *See* 1280, 1156, 1118.

1309. **England**—Public weighing machines are used at London. Improved crockery, with Italian or German glaze, is now made locally. *See* 1300.

Record of Progress

1311. **England**—Early mention of physical torture with instruments by State officials ; applied first to the Knights Templar.

1315. **Germany**—Walter Lollard preaches reformed doctrine for seven years ; his sectarians then enter England. *See* 1304.

1315. **France**—Emancipation of all serfs on the royal domains, effected by Louis X. Lyonnais is annexed ; seized in 1307.

1316. **France**—The Salic law is applied in royal succession ; this apparently was both Frankish and Saxon, also a Lombard law or custom. It was Danish and Gothic also.

1316. **Italy**—Mondino, medical man and professor at Bologna, does much towards founding modern European medical practice. (Originally it was Indian, and came into Europe through Arabs and Moors ; it then became an art practised by monks, afterwards by the Medical Knights.) He is the first public anatomist, and writes on anatomy.

1319. **Sweden**—The people are impoverished through the control of prices exercised by the Hanseatic League.

1319. **England**—Reputed general use of linen-made paper ; it seems, however, that the local manufacture of linen afterwards declines. *See* 1243, 1270 ; also 1386 and 1417.

1319. **France**—Ordonnance against prelates sitting in parliament, on account of the neglect of their sacred duties.

1320. **Flanders**—Lace manufacture exists, probably of woven lace, at Bruges. *See* also 1390. This woven lace was called cut work, and long preceded point lace, or knitted lace, which was a German invention of 1561, according to Beckmann. *See* 1454.

1320. **Italy**—Small fire arms or hand-guns are known at this time. *See* 1308. Apparently this is the earliest mention of such things, and they were experimental only.

1322. **Germany**—Saw-mills driven by water are used at Augsburg, and are termed Hanzey mills, apparently the earliest mention. Burning alive is introduced as a punishment for heretics at Köln, and applied in the case of Walter Lollard. *See* 1026.

1324. **England**—Earliest recorded trial for murder by sorcery, of John of Nottingham at Coventry.

1324. **Germany**—Reputed invention of gunpowder by the monk Berthold Schwartz. *See* 1118 and 1252. Probably he obtained some from Italy or Spain, learnt its constituents, and found out the way of making it. *See* 1308 and 1320.

1325. **Italy**—A striking clock is placed in the Campanile S. Gottardo, at Milan, which was made and perhaps invented by Wallingford, Benedictine monk, of London.

1326. **Italy**—Metal cannon for the defence of forts and of land are mentioned in an Ordinance of Florence. *See* 1320, 1308, 1280.

1327. **England**—The worsted manufacture is begun at Worstead in Norfolk by some Flemish settlers.

1327. **Netherlands**—William, count of Hennegall, Holland, and Zealand, prohibits the noxious adulteration of wine

Record of Progress

1327. **France**—Lyric performances take place at the Floral games of Toulouse.

1328. **England**—Cotton manufacture is first established at Manchester by Flemish settlers; the cotton probably comes from Egypt and the Levant. This manufacture dies out after 1373, when the Genoese occupy Cyprus. For later establishment, *see* 1641. Early mention of a grammar school at Thetford.

1329. **England**—Loaves of sugar are now sold in England; though doubtless honey was commonly used still. The sugar may have come from Cyprus, Sicily, or Spain, probably from Spain, where it had been grown since the ninth century by the Moslems. Some belief in transmutation still exists, for there is a royal demand for the services of two transmuters of silver.

1330. **England**—John Kemp, and other Walloon cloth-weavers from Brabant, invited by the king, settle at York, and afterwards at Bolton, and at Kendal. Apparently after some years their Kendal cloth manufacture passes into English hands, or is replaced by local English manufacture.

1331. **Spain**—Iron cannon-balls are used by the Spanish Moslems, in the campaign of Abu Abdalla Muhammad IV. against the rebellious African Moors; and perhaps in others against the Christians.

1332. **England**—Moorish or morris dancing introduced, probably through the Spaniards.

1332. **Italy**—Bartolomeo Verde proposes to build a windmill for the Venetians, for which, in the event of success, he will receive a piece of land. *See* 1300.

1333. **Spain**—Beginning of the eleven years' war against the allied Moors and Spanish Moslems.

1336. **Italy**—Rise of the Condottieri, commanders of free troops or companies, whose services were engaged by various towns and states when required. They resemble the Routiers, of the time of Stephen, in England.

1337. **Greek Empire**—The course of a comet is now first given accurately by Nikephoros Gregoras. It is also mentioned in Chinese records, which begin from 500 B.C.

1338. **England**—Glass of local manufacture is used at York Cathedral or Minster, now first completed. It is possible that some foreigner directed the work, for the glass commonly made was still coarse window-glass.

1338. **France**—Cannon are used at the siege of Puy Guillaume; and cannon are also mentioned in records as prepared for an attack on Southampton. *See* 1326, 1320, 1308.

1340. **England**—Blankets are first made at Bristol for bed-coverings; hitherto monastic clothing was made of blanketing. Copper money is used in Ireland and Scotland. Early mention of a tournament, held at Dartford; an invention of the eleventh century by De Preuilly.

1340. **France**—Cannon are used at the defence of Quisnoy, and

Record of Progress

are prepared for use at the siege of Cambray. *See* 1338. Playing-cards are used in the Lyonnais ; *see* Meliadus, B. M. Lib. fol. 313, where about twenty-four cards are used, though retouched in the drawing. An ornamental covered vehicle is drawn by a horse in shafts with postilion ; it holds a king and a second person. *See* 1269.

1342. **France**—The stationers of Paris, Toulouse, and other large towns, are compelled to have circulating libraries, with catalogues and at fixed charges, for the use of students.

1344. **England**—Gold is again coined locally, nobles of 6s. 8d. and marks of 13s. 4d. ; also the florin, or Florentine coin, of 10s. is introduced to replace the Byzant of the same value, coined at Byzantium, and used throughout Europe for long past.

1344. **France**—Gold is coined locally ; the George florins are coined at Orleans. Annexation of Dauphiné.

1346. **England**—Earliest mention of apothecaries, under that name of Greek admittance in the grant of a pension to Coursus de Gangeland, who was a druggist, and perhaps a prescriber accompanying the king.

1346. **Italy**—Rise of academies of artists ; the Società di San Luca is founded at Florence, afterwards there is one at Siena, and many in various Italian towns.

1346. **England**—There are some cannon at the battle of Crecy, but apparently are either used ineffectively, or not at all, as the English archers sustain the conflict against the French arbalist men ; but this is the earliest mention of English cannon of any sort, and of any cannon as field-pieces. *See* 1338, 1340.

1346. **Netherlands**—The Brussels museum is now commenced ; this is the earliest mention of anything under that name ; but several monasteries had reliquaries, and collections of curiosities. *See* 1120.

1347. **England**—Espringals and bombards are used by Edward III. at Calais. The beating of drums at his entry was a novelty, perhaps of Moorish origin and of Spanish introduction, like the morris dancing and the sugar-loaves, besides the use of cannon.

1347. **Germany**—Reputed date of the existence of paper manufacture at Munchen. *See* 1319.

1347. **Italy**—Chimneys have been known at Venice for some time. *See* 1300. The Venetians make a commercial treaty with Egypt ; Venetian commerce rises, and wealth follows, which is partly dependent on Asiatic commerce flowing through Egypt.

1348. **England**—Edward III. found the institution of Windsor for retired and infirm knights.

1348. **Spain**—The clarification of wine with gypsum is forbidden. *See* 1327.

1350. **England**—Improvement of highways, and introduction of toll-gates on them. Copper mines are worked at Skildane and Alton Moor. *See* 1189. Saffron is an introduction from the Levant, probably from Aleppo.

1351. **Germany**—Wire-drawing is practised at Augsburg.

Record of Progress

Until this time there have been only night-watchmen, placed as steeple-watch at Erfurt. *See* also 1253. Day-watchmen with mechanical clocks and gongs, who existed in China in the ninth century, and in India before that, are still unknown in Germany or in England; but they begin to be known soon after this time. Police, as in Spain in 1250, and at Paris 1257, are quite unknown.

1351. **Italy**—Flagellation and hair garments are successfully adopted as a remedy against the Plague. The Black Death killed twenty-five millions of persons in Europe in four years, 1348–51. Probably some bathing preceded the flagellation, and that was a novelty in this country.

1352. **England**—Lombard usurers are allowed privileges as a company; they can still fix their rates of usury without declaring them beforehand. The poems of Lawrence Minot on the wars are the earliest in later Middle English.

1353. **England**—Woollen manufactures are re-established in Western England, at Tiverton, &c.

1354. **England**—The export of iron is prohibited; probably it was wanted for the manufacture of cannon.

1355. **England**—Systematic impressment of seamen begins. Public women are compelled to wear distinctive dress.

1355. **Germany**—The constitution is reformed under Charles IV.

1356. **England**—Artillery is first used with practical effect by the English at the siege of Romorantin, which is taken. A king's guard of 120 picked mounted archers is now raised; they correspond to the mounted hus-karls of the Anglo-Danish kings.

1356. **Germany**—Gunpowder and cannon are purchased for the city of Nurnberg.

1356. **Italy**—Public striking clocks are set up at Bologna and at Padua.

1357. **England**—The herring fishery is now probably well established, for the trade in fish is controlled now by the Herring Statute. The Court of Admiralty is established.

1357. **Germany**—Painting in oil, before practised in Bohemia in 1297, is now well known to Nicolas Wurmser of Strassburg, whose picture is or lately was in the Vienna gallery. (Oil painting was well known in England in 1283.)

1357. **France**—Founding of the first Hôtel de Ville at Paris; it is used as a medical hospital.

1360. **England**—Rise of the Free companies, both French and English, that carried on desultory warfare. They resemble the Condottieri and the Routiers.

1361. **Germany**—A serious explosion takes place at the gunpowder factory of Lübeck; probably this was the first factory built for making gunpowder in Germany. *See* 1356.

1363. **Germany**—Cannon are first used in a naval conflict by the Hanse towns against the Danes.

1363. **France**—Guy de Chauliac writes a book on surgery, and about the medical knights. *See* 1316.

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1364. **Netherlands**—Petition of John, bishop of Liège and Utrecht, as to his losses due to the new mode of brewing with hops (*humulus*, or *hoppa*), introduced 30 or 40 years before. Hop gardens (termed *humulariæ*) had existed in Picardy in 822.

1364. **Italy**—Small hand-cannon are made in large numbers at Perouse (Perugia). *See* 1320.

1366. **Italy**—Cannon are used by the Venetians at the siege of Chioggia. *See* 1326.

1366. **China**—Record that fire chariots, fire umbrellas, guns, and matchlocks are used. *See* 1213.

1367. **England**—Coal is now generally used in houses at London; it had been used in factories for a long time. *See* 1305 and 1234; also 1245.

1367. **Italy**—Fire-arms made in Germany now come into general use. *See* 1364.

1368. **England**—Clockmakers from Delft are invited by the king, and settle in England.

1368. **Italy**—Chimneys are now built at Rome by order of Francesco de Carrara. *See* 1347.

1369. **England**—Nominal beginning of the Reformation by the Gospellers, or Wycliffites, who denounce priestly greed and dominations. There had been something similar in Italy by Fra Dolcino (*see* 1304) and in Germany (*see* 1315), and both of these things had some bearing on it; but it had no connection with the Albigeois heretical outbursts.

1370. **England**—Muskets are introduced by Sir Hugh Calverly; probably these are German. First revival of lighthouse building; the Black Prince builds the second Tour de Cordouan on the Garonne reef. The older ones were the first at the same place, the Dover beacon-tower, and the Boulogne Tour d'Ordre.

1370. **Germany**—Commercial development of the Hansards, who control the commerce of 108 towns, and can fix prices without restraint. First Swabian League to stop private wars.

1372. **France**—First ineffective prohibition of the practice of emptying pails from windows into the public streets of Paris; the attempt was due to the English.

1374. **England**—Early attempt at arbitration; the Conference of Bruges, consisting of seven English representatives and of the Papal Commissioners, endeavour to amend the grievances of the English Church.

1374. **Italy**—Sanitary regulations of Barnabo Visconte at Venice in time of plague, to remove the sick from among the healthy, and from towns into open air in the country. This method, now termed in India "immediate formation of cholera camps," had never been surpassed.

1376. **England**—The Commons of Parliament pray that stocks may be placed in every village.

1377. **Italy**—There now exists in many Italian towns small banking houses, or banks of exchange and deposit, termed

Record of Progress

"Apothecæ seu casanæ feneris," kept by feneratori. Probably the Wechselbanke in Germany spring from this origin.

1378. **England**—Public plays of a secular character are first performed; all before them had been religious, mystery plays and miracle plays. *See* 1100. John of Gaunt uses four hundred guns in the attack on St. Malo.

1378. **Italy**—Beginning of the Double Papacy that lasted for thirty-one years.

1379. **England**—Bills of exchange are mentioned in an Act of Parliament, and soon after this are declared the sole legal mode of sending money abroad. *See* 1307, 1245.

1379. **Italy**—The game of cards is brought into Viterbo; it comes from the country of the Saracens (Egypt?), and is with them called naib (English, napes; Spanish, naipes), according to Cavelluzzo. These were probably Egyptian taro cards, without any numeral cards among them; numerals had existed before this time in England, and probably elsewhere. *See* 1340.

1380. **England**—A court of minstrels is held at Tutbury by John of Gaunt; there had been minstrelsy long before, but this perhaps resembles the Eisteddfodd. In the year following he held a court of minstrels at Toulouse, in Guienne, an English province.

1381. **Italy**—Rockets (rochette) are known at Bologna; these were perhaps of Oriental introduction. They were anciently known in India, termed "bhan;" and even used in war by Bin Kasim, 717 c., at the siege of Allor in Sind.

1382. **England**—Some culverins or portable bombards are made in Guienne by the English. Queen Anne, wife of Richard II., introduces riding on a side-saddle from Bohemia or from Germany. Whirligig toys are much discarded from this time, and kept only for use on public occasions. Rise of public loans instead of aids and benevolences. Official suppression of the English Reformation by the Council of London, Bishop Courtenay, and by royal proclamation.

1383. **Italy**—Quarantine is adopted at Milan to stop the plague from entering the province and the town, but the period of detention is unknown; it may have acted as an edict prohibiting entry. *See* 1374.

1386. **England**—Capture of two French ships armed with heavy guns. Linenweavers, mostly banished from Louvain and Brabant, settle in London. *See* 1374.

1386. **Hungary**—Under the rule of Charles of Durazzo and Naples, the women control the Hungarian Court, and cause assassinations in order to maintain their influence.

1388. **England**—A custom toll on all whales brought into the port of Biarritz is granted by the Crown to Peter Bayne, a Vizcaino. The clergy are deprived of judicial power. Side-saddles, now commonly adopted, are by repute of Italian introduction. *See* 1382.

1389. **France**—Expulsion of Dominicans from the university of Paris for opposing the theory of immaculate conception. *See* 1140 and 999.

Record of Progress

1389. **Italy**—Pope Boniface on accession begins to sell ecclesiastical benefices, and paid agents overrun Italy to spy the infirmities of incumbents and report thereon, as the prices fluctuate with their reports. This seems the earliest valuation of life-contingencies and reversions on a systematic large scale.

1389. **Russian Duchies**—The Russians now use cannon; but the Mughals under Changer had them long before.

1390. **England**—Kendal cloth is now a native local manufacture. *See* 1330. Date of an English treaty with Bruges mentions the trade in lace with that town; this was probably woven lace only. *See* 1320 and 1561.

1390. **Italy**—First revival of Greek literature and language, which afterward extends throughout Europe, due to Barlaam, Pilatos, and Chrysoloras.

1390 c. **Granada**—A zharāf is sent to the king of Granada by Mensa Musa II., of the Melli dynasty, king of Timbaktu and the Sudan (1374 to 1407). The town Timbaktu had been rebuilt after 1326 by workmen from Spain and Marrākash.

1391. **England**—Parliamentary declaration of freedom from Papal rule; all Papal power in England is now abolished. (King John had merely denied the Papal right to tithe and toll, but granted frank almoigh.)

1391. **France**—Rise of artistic academies at Paris; the Académie de S. Luc is founded. *See* 1345.

1392. **Germany**—A windmill is erected for the town of Speyer, but a Hollander is required to use it and keep it in working order. *See* 1332, 1800.

1394. **England**—A Salter's Company is established; the mode of curing herrings is that due to Benkels, a Hollander. *See* 1357, also 1388.

1394. **Spain**—Date of the first ordinance about bills of exchange at Barcelona. *See* 1245.

1394. **Ottoman Empire**—Artillery is made near Edreneh by Bajazet I. for the first siege of Constantinople. The foundry is established.

1396. **Sweden**—Copper mines are worked in this country; reputed date of early mention.

1396. **Netherlands**—Painting in oil is introduced at Bruges by the brothers Van Eyck. *See* 1357, 1297, and 1283.

1397. **France**—Edict of the provost of Paris, forbidding labourers to play on working days at cards, bowls, ninepins, and tennis. *See* 1379, 1340.

1399. **England**—A copper mine is now worked in Shropshire. *See* 1350 and 1189. Copper money is now used only in Ireland and Scotland, and is not legally current in England, where the coins are mostly groats, half-groats, and pennies, all of silver.

1399. **Italy**—The disinfection of all clothes and things used by the plague-stricken is now first ordered at Milan. *See* 1383, 1374.

DISCOVERY IN SPECIAL BRANCHES.

Archaic Discoveries.

None recorded.

Chemical Separations, &c.

None recorded.

Naturalistic Note.

1350. Reputed date of the entire extinction of the bear in Iceland and Scotland.

1390. The zharāf is introduced into Spain from Timbaktu.

Exploration and Settlement.

1330 c. Re-discovery of the Canary Islands.

1344. Macham, an Englishman, discovers the Madeira Islands.

1347-51. The black plague kills many of the inhabitants of Greenland.

1390. Nicolo Zeno, a Venetian, is wrecked on the Orkneys, and protected by the Earl Henry Sinclair.

1391. Sinclair and Zeno conquer the Faro Isles (then termed Frisland) and the Shetland (Eastland). Zeno is driven to Iceland. Thence he went to Greenland, but he died soon afterwards.

1393-95. Almonaster, a Spanish gentleman, visits Lancerota, one of the Canary Islands, and takes away some of the inhabitants.

1395. Visit to the Canary Islands. (No settlement.)

1399 c. Antonio and Nicolas Zeno, Venetians, make explorations in Iceland and the Northern Seas.

African Voyages.

1298 c. First African Expedition of Muhammad al Lawāti,

called Ibn Batuta, from Tanjir to Tilmisen, Al Jazair, Bijāya, Kōsintina, Buna, and Tunis. From Tunis to Sawsa, Safākus, Kābis, and Tarābulus (Tripoli). From Tarābulus to Meslata-Mesurāta, Kasua Surt, the palace of Barsis, to Kubbat el Islām, and Alā Sikandaria. From Alā Sikandaria to Daruja, Dāmanhur, Fawwah, Al Mahrāriat, Al Muhalla el Kobrah, El Burlos, and Damiad. From Damiād to El Misr (Kahirah), and by Manfalut and Esnah to Aintab, whence he returned to El Misr, and went into Syria.

1351 c. African Expedition of Al Lawāti from Tanjir to Marrākash, and back to Fās.

1353 c. Last African Expedition of Muhammad al Lawāti, from Fās (Fez) to Sighilmāsa. Thence to Taghāri salt-mines, and to Abu Lātin, the first town in the Sudār (Nigritia). From Abu Lātin to Māli (Melli). Also to Zāghari, and to Karsanju, on the Nile (Niger), and back to Māli. From Māli to Timbaktu, Kawkaw (Ghāgo), Bardama, to Nakdāf copper-mines. Thence into Hakār territory, and back to Sighilmāsa and Fās.

Asia.

1296-1314 c. Travels of Fra Oderico da Pordenone, Franciscan, in Asia, Ceylon, Sumatra, and Borneo for sixteen years.

1350 c. Travels of Sir John Mandeville (h. at S. Alban's, 1300) in Asia and China, from 1327 to 1360. He died in 1372.

1396-1427. Travels in Asia of Johann Schlitberger, a prisoner of the Ottomans for thirty-one years.

[illegible]

Unexplored

FIFTEENTH CENTURY

1400 TO 1499.

PERIOD OF OTTOMAN CONQUEST.

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FIFTEENTH CENTURY

1400 TO 1499.

PERIOD OF OTTOMAN CONQUEST.

GENERAL DEVELOPMENT.

THE political causes of the comparatively small progress made in this century will be dealt with under the head of Hindrances.

The deplorable financial condition of most European countries was due to the long and exclusive privileges given to the Hansards, and to the unwillingness of nations to be taxed for their own national benefit. Venice was comparatively flourishing on its Oriental commerce; Genoa also till about 1470; Flanders and various towns of Germany were the homes of the members of the Hanseatic League; the Ottoman Empire subsisted on raid, ravage, and plunder; the Lombards were the bankers in some countries, the Jews in others. Among them, all the rest of Europe was reduced to national poverty. There were a few banks, that of Barcelona, founded in 1401; that of Genoa of 1407, and of Padua in 1490; but financing and funding were not understood; and national credit was valueless. The financial situation resembled that described as existing in the fourteenth century, but was worse. Towards the end of this century, France was formed and reinstated by a penurious, thrifty, and crafty man, of a disposition suited to a miserly usurer, or a petty merchant, without a touch of nobleness or honour in him, and cowardly besides; he amassed France in thirty years. Similarly, also, a very thrifty and parsimonious Welshman reinstated England on most penurious principles; his strength was in his purse; so, too, was the strength of an impoverished nation dependent on his personal

ability to provide for its defence. Forcible taxation adopted in 1495 was the only sure remedy for the future, when the nobles and gentlemen who had supported the nation in war were so reduced in number and in wealth. Some other countries were financially in a condition approaching these two cases, though not reduced by such political difficulties.

Science had some causes for awakening. Astronomy had ceased to be cultivated for astrological purposes ; but now was useful in its bearings on navigation.

Improved almanacs and astrolabes, good charts, and much knowledge useful in setting courses, were the result. Yet so little was the form of the earth known, that Cuba was originally deemed part of India, and the erroneous terms, West Indies and Indians, applied to the Antilles and Carib Islanders, or to indigenous Americans, survived that mistake for centuries. Among the astronomers were Martin Behaim, of Nürnberg, 1430 to 1509, who made the earliest tables of solar declination ; he was also a cosmographer, navigator, and map-maker, and died at Lisbon, perhaps in the service of Portugal. John Mueller, called Regiomontanus, from Königsberg, was the astronomer of Padua in 1463 ; he lived from 1434 to 1475, and died at Rome. George Purbach, from Linz, 1423 to 1461, made tables of eclipses and proposed a theory for the planets. Paolo Toscanelli, Tuscan, 1397 to 1482, corrected the Alphonsine tables, used a large gnomon and a meridian, and determined the solstitial points and the variation of the ecliptic, matters long known to the Arabs. But Christian astronomy had now fairly begun independently. Toscanelli also proposed to Alfonso V. of Portugal a western route to Asia, which he thought 120 degrees distant from Western Europe.

The navigators not only added to the knowledge of cosmography, but discovered variation of the compass, and caused improved maps or charts to be made. Those more prominent in this work were Andrea Bianco, from Venice, fl. 1430 ; the three or four Gaboti, who lived at Bristol ; the two Colombi, from Genoa ; Antonio Ferrari, fl. 1444, from Galatona ; Fra Mauro, fl. 1451 to 1459, at Murano, whose Africa in the Mappamundi included Guinea and Darfur, proving that he obtained much knowledge from Oriental sources ; Leo Africanus, or Giovanni, who added to the same branch of cosmography ; Paolo Trevisano, from Venice, 1452, 1505, fl. 1483, traveller in Ethiopia, who visited the sources of the Nile (but

whose book was lost) : also there was the inevitable addition due to exploring navigators.

An early attempt was made in Italy to forward natural science ; Pandolfo Colenuccio formed the first Italian museum of natural objects—1450 c. to 1504—probably at Pesaro, his birthplace ; he was also a philosopher, and probably that philosophy was deemed wicked, for he was accused of crime, and killed in prison.

Chemistry was neglected as much as ever, also Botany and Geology. Though gold was the undoubted object of many of the early explorations, the knowledge of the sands and rocks in which it might be found was yet unstudied ; and later there was a case of loading fifteen ships with supposed gold ore.

Mathematics necessarily advanced slightly in connection with Navigation, and some little in Algebra. Luca Paciolo di Borgo, 1450 to 1509, from Venice, published at Milan in 1494 the first printed treatise on algebra. John Lydgate, 1375 to 1444, was a mathematician as well as poet ; Cola Pesce, the Sicilian, was a mathematician, and perhaps based his aquatic feats on calculation ; Manetti, from Florence, 1396 to 1459, is mentioned as being a mathematician ; also Giovanni Dante, the aeronaut of Perugia, in this century.

As to the notions of electricity, gained in Italy in 1467, from experiments with globes of sulphur, this may be a recorded error ; or, at the most, they were valueless from not being followed up.

Turning to other branches of science, Rodolf Huysmann (Agricola), from Heidelberg, fl. 1430 c., was a scientist, not to be confused with George Landmann (Agricola), of the sixteenth century ; Andrea Acquaviva, duke of Atri, 1456 to 1528, was a cyclopædist of science and art ; so too Raffaele Maffei, from Volterra, 1438 to 1522 ; also strangely indeed, Baconian science, old in England, was a novelty in Italy. Leon B. Alberti, from Venice, 1404 to 1472, after experimenting in optics, invented the camera obscura (or optic camera) and magic lantern, a reticular frame for drawing objects, a deep-sea sounding apparatus, and other things. This is more strange because spectacles had long ago been invented in Italy about the time of Bacon. Giovanni Battista Dante, a mathematician who lived at Perugia and Venice, was a clever aeronaut, who flew across a lake several times, but was at last injured by a fall due to weak material in his wings.

Cola Pesce, the Sicilian mathematician, walked on or in the

water for very long distances, even to Lipari. Unfortunately, the folly of driving a clever man beyond his powers was committed by King Frederic of Sicily, who induced Cola to throw himself into the Gulf of Charybdis, and even after his exit in three-quarters of an hour with great difficulty, persuaded him to do it again; the result was fatal.

Among the inventions of this century were that of printing with fusile type instead of with wooden blocks, a much over-rated invention, ascribed to John Fust of Mentz, John Guttenberg of Mentz, and Peter Schoeffer of Gernsheim, 1457 c. This was introduced into the Netherlands by Mertens. In Holland, Laurent Janszoon, also called Koster of Haarlem, was the first real inventor of fusile type, had been the beginner, 1370 to 1439; in England, Caxton, a philanthropic introducer; in Venice, John of Speyer, in 1469; and in France, perhaps by Henri Etienne or Stephen, 1470 to 1520, or some forerunner that handed it down to him. A better invention was that of Maso Finiguerra, from Florence, of engraving on copper (1414 to 1452); but it was not much appreciated, for Raimondi in the following century copied from the Flemish School. It was also invented in Germany in 1450.

Finiguerra also invented working in niello, and a process of casting in relief, perhaps in gypsum. The art of cutting facets of diamonds was invented by Berghen at Bruges about 1476. Peter Schoeffer, from Gernsheim, also invented printing simultaneously in two colours; but this discovery, as well as the important invention of Basil Valentine in 1413, that of fulminants, was neglected. The excessive danger in handling fulminants was not balanced by any prospective reward.

A science, new to European Christians, sprang up in this century. Mondino had in the past century dissected corpses at Bologna, and had written a book on anatomy, but Popes and rulers had stopped the practice for a long time. It is supposed that Popes of this period believed in a carnal resurrection (though this was opposed to the doctrine of S. Paul about spiritual bodies), and hence thought that the ecclesiastical doctrine of resurrection would be set at defiance. After a long interval the emperor permitted dissection, and anatomy then became a science of the Christians. All the knowledge of anatomy used by surgeons had hitherto been based on the anatomical book on osteology and myology of Galen of Pergamus (Mysia), 130, and perhaps one or two similar Greek or translated Greek works; also on such knowledge as had

been acquired through the Moslems. Now the Moslems had certainly dissected animals, and gained much knowledge, though originally they too had translated from ancient Greek books. Thus the new science was of very ancient origin. In the period of revival, the great anatomist was Alessandro Achillini, 1463 to 1512; Bolognese, who availed himself of the permission of Emperor Frederic II.; and doubtless many Italians, both surgeons and artists, acquired valuable information at the end of this century from his school of public anatomy. Yet we find Galen's works re-translated from the Greek by Niccolò da Reggio, fl. 1417-45, who perhaps was also called Nicholas Leonicensus, 1428 to 1524, or this latter made an independent translation. At this time there was nothing of the sort beyond Italy; even in England, Thomas Linacre, 1460 to 1520, was merely aiming at a medical monopoly; medical degrees, or titles, like those instituted among the lawyers by Warner in the twelfth century, were the aim; self-exaltation, not extended skill and knowledge.

It was strange that when the Christian surgeons had just begun to arrive at a knowledge of bone and muscle, the Moslems were writing about the nerves and nervous diseases, as the work of James or John of Damascus, in Arabic, showed in this century. See also Badruddin, 13th century.

Among languages, the most useful language of science, Arabic, was neglected; a few travellers knew it, also Annio da Viterbo, or Giovanni Nanni, 1432-1492, a rare exception.

A knowledge of the Greek language and ancient Greek literature had been introduced in Italy by fugitives at the end of the past century; but in this century it was extended throughout Europe. The object was literary and antiquarian rather than scientific; the unequalled Greek poetry was a perfect model, like the statues of the best Greek period, and hence served to regenerate modern literature. It is sad that scientific progress was hence thrust back by this literary avidity; Europe suffered by it for centuries. The Greek teachers of this century were Joannes Argyropolos, fl. 1453; Dmitri Calcondila, fl. 1483; Theodor Gaza, fl. 1429; George Gemistos, fl. 1440 c.; Mark Musurus, fl. 1490; Constantine Lascaris, fl. 1454. There were also Italians that taught Greek—Filelfo, Guarini, Niccolò da Reggio, Ricchieri, Strozzi, Annio da Viterbo, and Bracciolini Poggio. There were also two wealthy patrons of Greek learning, Cosmo di Medicis the elder, 1389-

1464; and Palladio Strozzi, 1372-1462, who spent much in founding schools and professorships for this purpose.

In France, Greek was introduced in 1455 by Publius Gregorius, a Greek who had already taught at Naples, Milan, and Rome; and in 1473 by Tiphernas. In Germany, it entered about 1493 under Johann Reuchlin, or Capnio. But England was very unfortunate in not learning the language from Greeks; the result of Grocyn's book-learning at Paris was the Oxford mispronunciation, bigotedly kept up for five centuries by the clergy who monopolised education. There is no stronger proof of the need for restricting clergy to the education of clergy, and separating seminaries from institutions for lay education. Cornelius Vitellius had for a short time in 1488 taught Greek properly; but was not replaced by a Greek. Ecclesiastical conceit with a pompously vile mispronunciation had been preferred.

Education in the latter part of the century provided a knowledge of Greek as well as the Latin language, after the second introduction in 1460; for there had also been a former nominal introduction in the fourteenth century. A second ancient language was easily learnt by the ecclesiastics of the universities, and easily dispensed, hence they received an accession of strength. Otherwise, at this epoch, education would have passed from the clergy into the hands of scientific men, and of teachers of modern languages. In England some free schools were founded in this century, those of Enfield, Sevenoaks, Eton, Rotherham, Stratford-on-Avon, Stockport, and Sudbury. The education of men was helped by the establishment of many public libraries throughout Europe; but these were rarely free, or detached from other institutions. The Italian academies were very numerous, but nearly all were artistic academies. The effect of printing books must yet have been comparatively small from 1481 to 1499 on education of any sort, from the rarity and cost of the early copies. The beginning of speculation in copyright of books at Nürnberg, in 1499, was excellent for promoting common school books and light literature of large sale; it was, however, disastrous to higher learning and books for the few, while State encouragement of higher learning was not yet dreamt of.

The École de Médecine of Paris, founded in 1469, was relatively a novelty; so, too, was the appointment of numerous official druggists in Germany, who probably had some analogous arrangement for detached instruction, which is not recorded.

Construction and building did not progress much in this

century, relatively to increase of population and conditions. Comparatively few new towns were built, or even walled. The new castles and forts of this century are few, probably from the comparative uselessness of the castles of olden style when opposed to the newly-introduced cannon of the last century, now generally adopted. In England, many of the old castles were destroyed in the Civil War. Fortification against cannon had not yet been studied. In public works, very little was done in any country; a few stone bridges, a canal near Milan, some conduits in England. In buildings, there were many large cathedral churches dating from this century in every country of Europe, also many townhalls and guildhalls, and a few palaces or palatial houses, but comparatively few new abbeys, or priories, or monasteries. In England very few monasteries were built after 1414, when alien priories were dissolved. Besides, the French wars of 1430 to 1450, and the Yorkist strife of 1444 to 1485, left very short periods at both ends of this century for building anything, so that the scarcity of English buildings of this century has its own causes.

In mechanical construction, the improvement of guns and gun-carriages occupied much attention, to the exclusion of many other things; in Italy the fine arts, lyric drama, painting, and architecture were the absorbing subjects, apart from war. In England, pumps, improved sewers, better roads, and post-stages belong to this century, and the adoption of printing presses with fusile type was a novelty everywhere. Yet the excessive bareness of record of mechanical progress in this century is generally remarkable; development did not then run in that groove.

On the whole, this century is relatively non-progressive; and the obstacles account for it sufficiently. But in England there was some positive retrogression, resulting from the depression of everything from 1435 to 1485. This was not only half a century lost, with losses of population by plague, war, and famine, but the time thus elapsed, being more than the period allowed for a fresh generation, some of the useful knowledge and craft of the bygone generation was not handed down to their grandchildren, as their sons had not used or practised it. It is difficult to discover which were these lost useful arts. Some decline in skill in building the architectural details of the older style was one, and this was more marked from the later and immediate introduction of Italian, Renaissance, and Revival styles. The more remarkable thing was the extinction

of almost all knowledge of gardening, proved by the introduction of Flemish gardeners and vegetables in the sixteenth century into a country that was importing its commonest edible vegetables. It is supposed that in the Yorkist wars every garden was utterly ruined, and remained so; that most of the stocks of fruit and vegetables vanished, and were never again propagated, and that people accustomed themselves to do without fruit and vegetables generally. No effort was afterwards made to restore things, for the knowledge of gardening had gone. The bareness was perhaps relieved by a few of the really indigenous vegetables that could grow wild, certain cabbages, and the old Roman introductions that had been long acclimatised and were also hardy.

There may also have been other lost crafts and arts, but some of the notions about these require further support from record than they now have.

In the Fine Arts, Italy held pre-eminence during the century, though it had not yet risen to its highest development in any branch. Musical composition seems to have been left hitherto entirely with the leading musician of a band; but now, owing to the introduction of oratorios, repeated by bands apart from the composer, the names of composers begin to be recorded.

Francesco Baverini composed the music of the first lyric drama, 'The Conversion of S. Paul,' the words were by Giovanni S. di Verulani: it was performed at Rome in 1440. A secular lyric drama, 'Orfeo,' was performed at Rome in 1480; each being the earliest of its sort. Also, at the end of this century, Giovanni Tinctor, Neapolitan, wrote on music, the value of notes, and on counterpoint; he was musician to Ferdinand of Aragon, King of Naples. The whole was an Italian revival of music in a new direction.

Among painters of this century beyond Italy few names survive; they are these:—Roger of Bruges, d. 1445; Hans Hemling, d. 1449; Meister Stephen, d. 1451; Martin Schoen, d. 1461; Schorel (Holland), 1425 to 1492; Matsys Quintin (Antwerp); G. Hemmelinck, of Bruges; Antonio del Ruicon, in Spain, fl. 1446; and Bartolomeo, 1469 to 1517, introduced painting from Italy to France in the following century under François I., 1516 c.; also the brothers Van Eyk, of Bruges. Within Italy the painters, especially those of Tuscany, were very numerous; they received great encouragement from the clergy who required altarpieces, and were willing to pay well for them. Yet none of their productions were excessively good

till near the end of the century, when anatomy had been studied, or till the next century. However, the development took successive steps; Massacio, a Tuscan, 1402-1443, gave the appearance of life and motion instead of listlessness; Bramante led the way to Lomazzo, and perhaps to Barozzi, in perspective correctness, though Bramantino Suardi in the following century reaped chief advantage from it. After the use of oil as a medium, Domenico Veneziano adopted bold light and shade. Leonardo da Vinci, 1452 to 1519, probably had studied anatomy, but his great achievement was not an anatomical development, but a higher conception of the principles of beauty carried out in his works. Thus, though anatomy had not been thoroughly studied, and the beautiful Greek statues of the Laocoon and the Apollo had not yet been unearthed, much progress had been made; for these Italian painters adhered to their own schools, and congregated in academies; thus the small progressive steps were sure to accumulate to some extent.

There were also some excellent Italian sculptors in this century—Donatello, Verrocchio, Leopardo, Filarete, Brunelleschi; but, if sculpture had hitherto been in advance of painting, at the end of this century, the difference was small.

In poetry, romance, and the drama, this century is a transition period; lyric oratorio, secular lyric drama, and pure comedy were coming forth, and the troubadours, the rhymers, and the metrical chroniclers, were lessening in number. Bibbiena wrote the 'Calandra,' Ariosto wrote a comedy also. Lydgate wrote poetry, also the Marquis de Villena, and Sanzaro and a few Italians seem to have made versifying their pastime; but things had changed. Those that could read Greek poetry, dramatic, lyric, or epic, did not care for the comparative trash of modern or contemporaneous poetry in any European nation; they were at the two ends of the scale of graduation. The European dramatist had not yet fairly developed, the minstrel had fallen into the shade.

POLITICAL CONDITION.

The political condition of Europe was less favourable to progress than that of the last century. Externally, there was an Asiatic and Moslem invasion of Europe, a conquest of the Lower Greek Empire, and aggressive Ottoman wars against neighbouring European nations. Europe did not wish to avert the former, for the experience of the crusaders of preceding times in Greek treachery had rendered Europe callous to Greek disasters ; but Europe perhaps did not foresee the latter result. Even had it been foreseen, the experience of the Latin Empire of Constantinople did not encourage a similar attempt on the part of the German Empire and of Hungary, the nearest and natural defenders of Europe against Asiatic intrusion, even if they had been sufficiently strong to do it. As a counterpart to this invasion, the last Asiatic invaders, the Mughals of Kipchak, steadily became more feeble, until the freedom of the Russian duchies was attained in 1480, followed by their ascendancy in 1502 ; and this was partly due to the Ottoman conquest of the Krim Khanate in 1475. The Mughals were unsupported from Asia on the east, and driven in on the south, they hence failed to defend themselves on the north.

Within Europe, the wars were longer and more serious than those of the fourteenth century. Germany was never strong enough to resist the Ottoman conquest and occupation of Hungary from 1441 to the end of the century ; while in the earlier part of the century from 1414 to 1436, the Hussite wars of the Bohemians crippled it. The Italian states were seldom at rest with each other throughout the century, and near the end of it had to repel the Ottoman invasion of 1477-79, and the French invasion of 1494 and 1499, with the involved wars and difficulties accompanying them. Pohlen had gathered strength from union with Lithuania, and other acquisitions, as that of West Prussia and the Baltic provinces ; it also formed dynastic unions with Hungary and Bohemia, and was suzerain as far south as Moldavia, even including it, as well as Podolia and Polish Russia. It protected its own

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possessions, in Southern Lithuania against the Mughals in 1476, but was never bold enough to help the Russians against them. Pohlen in its strength, after rising from utter ruin and desolation caused by these Mughals, was a selfish and greedy upstart state that helped none; it was however driven in by the Ottomans in 1498, who took 100 000 Polish captives during their successes in Podolia; and to foretell the future fate of Pohlen could not then have required a prophetic seer from among its Jewish population. Hungary and Bohemia were usually in turmoil, and their connection with Pohlen was a political error. The triple kingdom of Denmark, Sweden, and Norway, a fortunate revival of ancient conditions, existed throughout the century, but it was marked by frequent civil wars and Swedish revolts, and the reign of Eric of Pomern was very different from those of the Skioldungs. But the Hanseatic league, controlling the purse strings of Europe, supported the Holsteiners in claiming Sleswig, attacked Kopenhagen and destroyed a fleet at Stralsund, leaving Eric powerless. The Oldenburg dynasty then began to rule, and eventually recovered the lost Duchy and the lost county; but these Oldenburgers rather remained as postholding kings than as rulers or leaders of the factious kingdom for the rest of this century.

Spain, consisting of Castilla and Aragon as leading states, was in a state of chronic warfare with the Spanish Moslems till their expulsion in 1492, and the Final Union to form Christian Spain. But Aragon had branch dynasties, and owned Sardinia first in 1309, and finally in 1428, Sicily since 1282, and Naples after 1442; the latter had to be defended against René and his Provençals, afterwards against the French invasion of Charles VIII. in 1494-95. Navarra was Spain beyond the Pyrennees to some extent, but under a French dynasty; and it remained so throughout the century, not being annexed direct to Spain until 1525.

The rest of Europe consisted of Burgundy, Guienne, various provinces fluctuating between the Valois and the English; a very small amount of territory free of English claims under the French Valois; and lastly England; for the Flemish and Batavian duchies with Elsass and Waasgau became part of Burgundy in 1473, Flanders itself having gone in 1370. There were in these countries, besides the fluctuating dukes of small provinces, three ruling powers, Burgundy, the Valois party calling themselves France, and England; while the

small provinces were Bretagne, Normandy, Provence, and the small provinces between Normandy and Guienne. Burgundy was an upstart kingdom, formed around a duchy by annexation and purchase, it was grasping and unscrupulous, treacherous on convenient occasions ; but as it included Flanders with its commercial wealth, and a number of towns of the Hanseatic confederation, it was the wealthiest kingdom, as far as financial support was considered. England was the rightful suzerain of all French territories hitherto ruled by the Capet dynasty, and this had been admitted in a whole series of treaties. Henry IV. was a usurper, his son also virtually ; but under the Treaty of Troyes, May 21st, 1420, Henry V. and his heirs were admitted to be heirs of all the possession of Charles VI. of Valois and his dynasty. Until the death of the Regent of England, the Duke of Bedford, in 1435, all went well ; though Charles VII. had claimed the crown in 1422. But Philippe of Burgundy was perfidious, and joined the Valois for territorial payment, the Hanseatic league supported him with their wealth, and the English were expelled from Guienne in 1441 to 1444. England had been impoverished by the Hansards, its treasury was empty, plague killed half the garrisons in 1437, and the English at home were starved by famine in 1438, many subsisting on wild roots, and could not reinforce their garrisons or supply them. In 1448 the Yorkist dissensions began, and the Valois took the opportunity of driving the small English force out of Northern France in 1448 to 1450, breaking successively all terms and treaties made with them. When nominally victorious, still dishonest.

Perfidious and greedy Burgundy met with its deserts : hardly had it received its full development in 1473, when in 1477 it became a province of the German Empire, the duchy alone falling to France, and that without just claim.

France under Louis XI. from 1461 to 1491 became a large kingdom by war, trickery, purchase, lapse and annexation ; after 1491 it became aggressive in Italy.

England was occupied with the Yorkist war and strife from 1444 to 1485, when the thrifty Henry of Richmond restored order ; but it was not till 1495, when the English learned to submit to taxation for the national good, that England began to rise again among nations. Nor did she gain real power till she learned to dispense with Hansards, Lombards, and Jews, and do her own work for herself, without dependence on the faith of past treaties.

Purely religious war on a large scale began in this century; the Hussite war of 1414 to 1436 was serious compared with the first little Apostolhan war of 1304 to 1307 under Fra Dolcino. The terrors of the Later Inquisition began after the Papal Bull of Sixtus IV., Francesco della Rovere, in 1478.

Civil war was not more destructive in Europe generally in this century than before. In Germany, the disorders due to the weakness of Imperial control of its provinces had to be put down with the help of a second Swabian league. The Italian internal wars were political rather than civil. The succession difficulties of Pohlen, Bohemia, and Hungary were certainly civil wars, but often were due to the vicious custom of making succession dependent on popularity. The countries that suffered most from real civil war were England, and the triple kingdom of Denmark, Sweden, and Norway, also the Spanish kingdoms, which could only when united withstand the Moslem.

Pestilence ravaged Europe more than heretofore, and perhaps the famines were as long and as frequent, certainly quite as severe. The new plagues that arrived, according to some records, were the Sweating Sickness, and the Morbo Gallico; but the more ancient plague ceased to come. The old plague visited France and England 1406-07, Paris in 1418, France in 1437. The new plague on the Continent and in Asia lasted from 1445 to 1460, and entered England in 1485, again in 1499. The famine of 1438 in England was one of the most severe on record; there were also dearths during and after the civil war. In Italy there was plague in 1423, in 1450, or from 1445 to 1460, and again in 1485.

RECORD OF PROGRESS AND EVENTS

1400 TO 1409.

PERIOD OF OTTOMAN CONQUEST.

1400. **England**—Date usually assigned to the revival of learning in England, following the death of Chaucer. It was a new period of English literature, resulting from the English poems of Minot in 1352, the use of English in law-pleading adopted in 1362, and the general disuse of the French language by barons and gentlemen in 1391, and the writings of Chaucer.

1400. **France**—Two very large bells are cast in Paris, weighing several tons ; hitherto tower bells had always been small.

1401. **England**—Burning alive is newly introduced by Act of Parliament as the punishment for heretics, instead of the perpetual imprisonment decreed in 1381. It is first applied in the case of William Sautré, 12 February. It was an Italian custom of 1026, and had been adopted in Germany in 1322.

1402. **England**—Decimal arithmetic comes into use.

1402. **Spain**—First colonial settlement in the Canary Islands under Béthencourt ; re-discovered c. 1330.

1404. **Bohemia**—Rise of the Bohemian reformation under John Huss, confessor to the queen, and Jerome of Prague ; they preached in 1409 partly the Wycliffe doctrines, denunciations of ecclesiastical domination, greed and mendicity, and of forced tribute to the Pope, and of priestly concealment of gospel teaching ; but they also went further by denying transubstantiation and other matters. The whole gave rise to the Hussite war in 1414.

1405. **England**—Cannon are used to batter down a tower at Berwick ; apparently mortars and guns were hitherto directed against troops only, both in sieges and in the field. *See* 1356.

1408. **Netherlands**—A drainage pump, fixed in every respect, is set up at Alkmaar ; at first it is worked by horses, afterwards wind-power is used.

1409. **Germany**—An apothecary's shop, 'the Golden Lion,' is opened at Leipzig, after transfer from Prague, where it had long

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existed attached to the university (not before 1360). Notice in 1345 an English apothecary; and some English communication with Bohemia. *See* 1380. Queen Anne being the sister of Vencelass, emperor of Germany and king of Bohemia.

1410. **Netherlands**—Old reputed date of the introduction of painting in oil. *See* 1396. Perhaps it was now commonly known.

1410. **Germany**—Wire-drawing introduced at Nürnberg. *See* 1351.

1411. **Russian Duchies**—Marten skins, squirrel skins, and even pieces of them, called mortki, are still used as money at Novgorod. (Probably they were stamped or sealed in some way, as representative paper money.)

1412. **England**—The making of gunpowder on a large scale now begins (*see* 1361); and in two years from this the export of gunpowder is forbidden.

1412. **Hungary**—Case of pawning a territory. Zips is pawned to Poland for 37 000 Prager Groschen; but this district is never redeemed.

1413. **Germany**—Basil Valentine, a monk at Erfurt, describes the process of making fulminating gold.

1414. **England**—Close of the abbey and priory building period. After the dissolution of all alien priories, not conventual, in this year, few are built.

1414. **France**—Muskets are used at the siege of Arras; probably the French used them before this time.

1415. **England**—The tendency to a nationalization of the Church of England is now indicated by the general adoption of the Church service according to the custom of Old Sarum, which had hitherto been local or partial. York use was the original Romish mass, as the York missal shows.

1416. **Italy**—Beginning of a long period of witchcraft mania. The brutal atrocities on supposed witches perpetrated under the patronage of the Holy Office, or Inquisition, last for a century from this time; the executions are very numerous, and the terrorism must have been frightful.

1417. **Pommern**—Knitting is known, having probably been introduced by Sophia of Moravia, wife of Duke Bogislaus VIII.

1417. **England**—Linen-made paper again becomes common. *See* 1319 and 1386. The paving of the chief streets of London begins by Royal order, commencing with Holborn; also permanent street-lighting in the winter season. Regulations about letters of marque are issued; but the adoption dates from 1295.

1417. **Portugal**—Zarco's ships first carry guns. *See* 1384.

1418. **England**—The Duke of Gloucester uses red-hot shot at the siege of Cherbourg.

1418. **Flanders**—Date of the earliest, or one of the earliest, large wood engravings, found at Malines; small ornamental letter blocks and cuts were ancient. *See* 1100.

1419. **Germany**—Early notice of the right of collecting and

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searching for saltpetre, perhaps to make aquafortis or gunpowder, in the grant of Gunther, Archbishop of Magdeburg, of rights in the district Gibichenstein.

1420. **England**—Some improvements or modifications in woollen manufactures are introduced by refugees from Holland; probably these were economic advantages, as the English cloth had long been the best in Europe. *See* 1380. The refugees may have been driven away by some inundation, or may have migrated to obtain religious freedom.

1420. **Portugal**—Saw-mills are set up in the Island of Madcira; also the vine and the sugarcane are planted there; this is the second colonial settlement of the Portuguese. The Madeiras had only been rediscovered in 1418-19 by Zarco and Tristan Vaz. *See* 1322.

1420. **Italy**—Captain-general Pietro Mozenigo employs flag-signals in giving orders to the Venetian fleet.

1422. **Portugal**—The ordinary Christian era is now adopted.

1422. **Ottomans**—Murad II. uses some very large cannon at the second siege of Constantinople.

1423. **England**—The large mart for the continental trade in English woollen goods is now at Calais. Yet Calais had been a staple town throughout the 14th century, and wool was a staple commodity. Perhaps the export had been stopped.

1423. **Italy**—Earliest possible date of the establishment of the Lazzaretto Vecchio of Venice, the first pest-house in Europe by repute.

1424. **England**—The export of sheep is now forbidden for fear of ruining the woollen trade of the country. Secret societies and brotherhoods are prohibited; but this is reversed by Parliament after five years.

1425. **England**—Pumps now come into common use; the invention was very ancient, as such things were known to Hero of Alexandria and to Apollodorus at Rome; but they had never been commonly adopted. From a sanitary view the arrangement was cleaner, as the wells could be kept covered at all times, and the well-water preserved from contact with the bucket. The Burning Alive Act of 1401 is adopted in Scotland by James Stuart I.

1427. **England**—Commissioners of Sewers are first appointed now, and seem to be the first sanitary authority or board for dealing with this subject. Apparently at this time the drains led either to cesspools or to the nearest brook; so that these commissioners could merely control the condition of the small sewers then used, and the emptying of cesspools for cartage to the land. In Northumbria drainage irrigation had been introduced by the Danes on their early settlement there, but was almost unknown in southern England.

1427. **Germany**—A saw-mill is used at Breslau. *See* 1420 and 1322.

1428. **England**—Reputed date of a petition to Parliament

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against the planting of hops in England, termed "wicked weeds," and said to engender melancholy. Yet the other effect of using hops was to preserve the beer longer, and to reduce the amount of malt hitherto necessary. Probably this was the result of some agitation raised by maltsters. Wormwood and various indigenous herbs had been hitherto used.

1430. **England**—The beginning of the National Debt is assigned to this year; but apparently there was no improvement of the national finances, or of supply for national purposes. The term "gentleman" becomes more usually adopted for descendants of noble families instead of "esquire," which since 1345 had signified the same thing, independently of all service. The old terms were, in Anglo-Saxon, "gesiht cund men," in Anglo-Danish, "hearth-men," and among the Anglo-Normans, "francigençe" and "associates."

1430. **Netherlands**—Laurence Koster, of Haarlem, uses movable and fusile metallic type in printing.

1430. **Italy**—Muskets of some sort are used at the siege of Lucca. *See* also 1320, 1414.

1432. **Portugal**—Beginning of the series of explorations along the African coast from Cape Bojador that ended in 1492 in the discovery of the Cape of Storms. The Azores had been recently discovered by Vander Berg and Cabral, but not settled.

1433. **Hungary**—Woollen manufacture is established at Ragusa either by Florentines or by some Italians from Florence.

1435. **England**—The Hanseatic league assist the Valois party and the Bugundians, who now desert the English cause. This financial support contributes almost as much as the plague of 1437 and the famine of 1438 to the expulsion of the English from Guienne in 1441.

1435. **Spain**—Insurance is commonly adopted at Barcelona; probably it applies only to cargoes or parts of cargoes of ships.

1437. **Malta**—John de Lastie, grand master, draws up statutes and defines the duties of physicians and surgeons.

1438. **France**—Attempt of the Assembly of Bourges to obtain the liberty of the Gallican church as in 1298, and to resist the Papal nomination of French bishops.

1440. **Sweden**—Hops are not yet much cultivated, though wild hops exist, and are probably indigenous; the wild sweetgale *myrica* gale is commonly used in beer. *See* 1428.

1440. **England**—Muskets of a new sort, called scorpions, are now used.

1440. **Germany**—Johann Gutemburg, of Mentz, uses movable metallic type in printing. (But the date 1442 is frequently assigned to this.) *See* 1430. Edict of Basel that a public physician be appointed to every Imperial city, with an ecclesiastical benefice or canonry, to perform cures gratuitously, but the drugs are to be bought at the apothecary's shop.

1440. **Italy**—A sacred lyric drama, "The Conversion of Paul,"

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is performed at Rome, and is the earliest oratorio on record. Lomazzo introduces a knowledge of perspective. About this time Antonello of Messina begins to paint in oil, a medium hitherto unknown in Italy, and perhaps acquired from John of Bruges. Thus backwardness is very remarkable. Whereas in England perspective was known in 1279, and pictorial painting in oil was known before 1288.

1442. **Germany**—Schaeffer adopts matrices in type founding.

1444. **Switzerland**—The eight confederated cantons of Transpuran Burgundy are now called Switzerland.

1444. **Italy**—Rise of the Italian style of architecture, which afterwards pervades all Europe, with various modifications. The first popular example of it is the cathedral church of St. Maria del Fiori, completed this year by Arnolfo di Lapo.

1445. **Europe**—A severe and long plague begins this year, and pervades Europe and Asia for fifteen years; it is considered the first of a special series, and of the same sort as the English plague of 1485.

1445. **Germany**—The city of Augsburg appoints a salaried apothecary to keep a public shop and sell drugs. *See* 1440, &c. But in this case the nominee was a widow carrying on her late husband's business, and thus proving an earlier rise of salaried druggists.

1446. **Spain**—Archil, or orchilla weed, producing litmus, is discovered in the Canary Islands.

1447. **England**—The rack is introduced at the Tower of London; for other mechanical tortures *see* 1811.

1448. **England**—The Hanseatic League, which still has commercial privileges in England, now openly declares war, and helps the Valois against the English in Northern France. The financial difficulties of the English are extreme, and the revolt of Richard Duke of York, who claims the crown, completes their ruin. *See* 1485.

1450. **Germany**—Engraving on copper is now practised.

1450. **Portugal**—The exploration of the African coast has now reached the Gambia River. But this year a settlement of Flemings and Portuguese is made at St. George's Island in the Azores, and a Portuguese settlement at Argum. Also the Cape Verde Islands are discovered about this time by Noli. The trade in gold dust now begins at Argum, also the slave trade.

1450. **Italy**—Pictorial effects in chiaroscuro, or light and shade, are introduced by Domenico Veneziano at Venice. He learnt oil painting from Antonello of Messina. Hydropathy is introduced into Italy, probably as a curative treatment for the plague, and perhaps from the Levant, for hydropathy was well known to the Arabs, and was explained by Abu Sina in 1205.

1453. **Ottoman Empire**—Enormous cannon and shot made near Edreneh are used at the third siege of Constantinople; the calibre of some is 36 inches, and some were of brass. The

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Ottomans find alum-works near the town, a manufacture that had existed before at Roccha (Edessa) : doubtless these were connected with some dye-works, belonging to Jews or Greeks, for dyeing the Turkey red, not yet produced elsewhere in Europe.

1454. **England**—Complaint of the London threadworkers that six foreign women introduce cut-work, or darned lace, formerly unknown. Probably these were Flemish women. *See* 1320.

1455. **Germany**—First printing of the Vulgate, or Mazarine Bible, at Mentz.

1456. **Flanders**—Louis van Berghem, of Bruges, discovers the art of cutting diamonds into regular facets ; he probably used corundum or adamantine spar, or perhaps the dust of selected hard diamonds.

1456. **Germany** — An official apothecary, who is also a physician, named Johann Kettner, is appointed at Stuttgart by Count Ulrich ; apparently he is given the monopoly of selling drugs at fixed prices throughout Wurtemberg (not yet Suabia).

1457. **England**—Reintroduction of pawnbroking.

1457. **Germany**—Fust and Schoeffer first attempt to print in colours at Mentz. The almanacs of Purbach, the astronomer, are now printed.

1457. **France**—The Hungarian ambassador of Ladislaus V. brings a coach (probably suspended) as a present to the Queen of France. This is perhaps the earliest specimen of the true coach, Gutshi, in Western Europe.

1458. **Germany**—Tin mines are discovered and worked at Altenberg, in Saxony ; these seem to be the earliest known tin mines on the continent of Europe ; all tin hitherto had been worked in England or in Bohemia. *See* 14th century.

1458. **France**—The Greek language and literature is now taught at Paris ; it was introduced by P. Gregorius in 1455.

1460. **Europe**—Date assigned to the revival of the knowledge of Greek by the dispersed Greeks throughout Europe.

1460. **England**—Engraving on copper is introduced. *See* 1450. The invention was both German and Italian.

1460. **Italy**—Large alum works are started at Ischia and Tolfa by Giovanni di Castro for the Pope. Perhaps those at Volterra in Tuscany were earlier. Gian Balbi publishes a Latin dictionary at Genoa.

1462. **England**—Lead mines are now worked at Derwent ; perhaps merely worked again after a long interval.

1462. **France**—Post offices and posts are established at Paris. This is a matter in which all Europe has been behindhand ; everywhere in Asia a postal service had been carried on for immense distances from ancient times, but in Europe the work was in early times deemed servile, and hence was neglected or badly done.

1463. **England**—Act forbidding the import of foreign playing cards, perhaps from Germany, in order to protect local manufacture. *See* 1340, 1379, 1397.

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1464. **Spain**—Some Cotswold sheep are presented to Enrique IV. of Castilla and to Juan II. of Aragon by Edward IV. of England. The export of English sheep had ceased in 1424.

1464. **Italy**—Reintroduction of pawnbroking at Perugia.

1465. **England**—New gold coinage; the gold ryal of ten shillings, and the gold angel of six shillings and eightpence, which corresponds to the noble. Rise of the vicious custom of offering rewards for evidence that will ensure conviction of suspected persons; it begins with the Parliament of Trim, and is directed against assassins and robbers, but it lasts for centuries.

1465. **Italy**—Printing is introduced at Subiaco in the Papal States; and at Venice in 1469.

1466. **Portugal**—The first printing press is set up at Leira, or Liria.

1467. **Spain**—The import of sheep from England now begins, giving rise to a more useful breed in Spain.

1467. **Italy**—Reputed date of some early notions about electricity, gained from experiments with globes of sulphur.

1468. **England**—Movable wooden type is used at Oxford by Frederic Corsellis down to this time.

1469. **France**—The first printing press is established at Paris. The *École de Médecine* of Paris is founded.

1470. **England**—Post stations, twenty miles apart, are established throughout England and Scotland, but apparently there is not any fixed charge for post-horses. *See* remarks attached to 1462.

1470. **Pohlen**—Almanacs are now first published in this country. *See* 1457 and 1473.

1470. **France**—Side saddles are used in France, and peacocks are known; burning at the stake is apparently still in vogue. *See* B. M. Lib., Perceforest, 19 E. ii. and iii., fol. 152, 244, 348. Horsed litters are still used in spite of the introduction of a coach in 1457; and harps with nine strings are played. *See* B. M. Lib., Cleriadus, Royal 20, ii., fol. &c.

1470. **Italy**—Organs are now commonly played in churches, a Greek introduction, for they were known at Constantinople long before. Andrea Verrocchio invents casting models of plaster of Paris, gypsum, or took it from Finiguerra.

1471. **England**—Some Flemings in the English service use guns handled by two men; wallpieces. Degradation of knightly orders by bestowing them on useless tradesmen.

1471. **Italy**—Pope Sixtus IV. commences the sale of indulgences as a mode of raising money.

1471. **Russian Duchies**—Conquest and annexation of Permia; hitherto independent from remote times. The Perms had in the sixth century controlled the commercial land route from Asia to the Baltic shore, and hence with Denmark.

1473. **England**—English almanacs now give declinations of the sun and of some stars, also tables for obtaining latitude from observations on the Pole star. Seamen still use the astrolabe,

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which apparently is like that of the time of Chaucer. The national funds are still unsupported, and recourse is again made to the old system of benevolence.

1473. **France**—Gregory Tiphernas reintroduces the study of the Greek language. *See* 1458.

1474. **England**—The commercial privileges of the Hansards are restored to them by Edward IV. Caxton prints Lefebvre's "Historie of Troye" at Bruges with the type of Colard Mansion. He also sets up the first printing press with movable fusile type at Westminster.

1474. **Germany**—A close carriage is first used by the Emperor in wet weather. *See* 1340 and 1457. Probably this is a Hungarian coach.

1474. **France**—The barbarous device of promising terms before the surrender of a town, and killing the people of it afterwards, is still practised. It is done this year at Lectoure by Louis XI.

1475. **Spain**—A printing press is first set up at Barcelona.

1475c. **Hungary**—A small standing army, or guard, called "the Black Troop," is now established, but it is massacred c. 1495 because it asks for arrears of pay, in the time of Vladislas, king of Bohemia and Hungary (of Polish dynasty).

1476. **Italy**—Painting in oil in the style of Antonello of Messina is adopted generally. *See* 1450 and 1440.

1477. **England**—Movable fusile type is manufactured locally. Caxton prints his first book with it, "The sayeings of the Philosophres." Wooden type was used before in England.

1477. **France**—An improved siege train is now used, in which the guns are light, and the gun-carriages are of convenient form.

1478. **England**—The game of clossh, or clossynge, apparently ninepins, is now prohibited.

1478. **Italy**—The Papal Bull of Sixtus IV., Rovero, on 1 November, establishes the modern Inquisition, or Holy Office.

1480. **England**—A printing press is established at the Abbey of St. Albans. *See* 1474, 1477.

1480. **Italy**—A lyric drama, "Orfeo," is performed at Rome. *See* 1440.

1481. **England**—A new plague, called the sweating sickness, now first enters England, but it is also considered to be the same as the Continental plague of 1445 to 1460.

1481. **Italy**—Books in Greek are printed at Milan, and books in Hebrew at Soricino.

1482. **Portugal**—Gold is now worked direct by the Portuguese on the Guinea coast.

1482. **Italy**—Reputed date of the earliest knowledge of the pedometer, through a carving on the ducal palace of Urbino.

1483. **England**—Reintroduction or improvement of post-houses and stages. *See* 1470. The statutes are now printed. Protective laws are made, putting alien craftsmen under disabilities, and forbidding the import of some goods that could be made locally.

Record of Progress

1484. **France**—Statutes controlling druggists are drawn up by order of King Charles VIII.

1485. **England**—First appointment of commercial consuls to represent the rights of English merchants abroad, beginning with Florence. Revival of boxing. The severe plague introduced this year by the foreign troops of Henry of Richmond is the sweating sickness; a series of these continue till 1551.

1485. **Italy**—First sanitary council of Venice endowed with full powers is appointed; it consists of three noblemen, who inspect lazarettos, enforce quarantine laws, and examine the health records of ships; they also imprison or kill all persons opposing their orders. *See* 1374, 1383, 1399.

1487. **England**—The Star Chamber is instituted, or remodelled, to control large contracts and public conventions with Jews; but its aims were afterwards altered often.

1487. **Portugal**—The explorations of the African coast since 1450 have resulted in the discovery of Sierra Leone in 1462, the Gold Coast in 1471, and this was followed in 1481 by making a fort—El Mina—on the Ashanti coast. Afterwards Benim was discovered in 1483, the River Congo and Angola in 1484, and the Cape of Storms in 1487.

1487. **Italy**—The use of gunpowder in military mines is unsuccessfully adopted by the Genoese at the siege of Sazzana; this was the invention of George of Siena in 1480.

1487. **Russian Duchies**—Reintroduction of the use of artillery, used before in 1389.

1488. **England**—The Greek language is taught at Oxford by Cornelius Vitellius. *See* 1390, 1458, 1460, 1473, 1481. Building of "the Great Harry" warship.

1488. **France**—Massacre after a battle is still a French custom; it is done at St. Aubin, 28 July. *See* 1474.

1488. **Germany**—The second Swabian League is formed to prevent private wars, and to support the Emperor.

1489. **England**—The double ryall of twenty shillings is now first coined and issued. Suppression of English piracy in the northern seas by a commercial treaty with King John of Denmark.

1489. **France**—Great improvements are made in the construction of gun-carriages. *See* 1477.

1490. **England**—Sanitary Act, forbidding the slaughter of animals within the walls of any town, aimed at reducing the spread of the sweating sickness. Some fresh development of paper manufacture begins at Hertford in Tate's mill; there had been an interval in which paper was imported from Germany or the Netherlands. Improved sea-charts and maps are introduced by Bartolomeo Colombo.

1490. **Germany**—Basil Valentine, monk at Erfurt, discovers the medical properties of the Oriental cosmetic, antimony. Watches are invented at Nurnberg. Poetry begins to flourish.

1490. **Portugal**—Some modification of the astrolabe, named

Record of Progress

a Jacob's staff, is effected by two Jewish physicians of Lisbon, named Roderic and John. It is intended for nautical purposes.

1490. **Italy**—Table-forks are used in several Italian towns, but not elsewhere (Galeotus Martius). It is supposed that the rise of the use of table-forks was due to the feeding of the plague-stricken, who might not take liquids. The Belvedere Gallery of Fine Arts is established. Ores of cobalt, smalt and ultramarine are imported from Saxony and Bohemia.

1491. **England**—Grocyn introduces the study of the Greek language; it is supposed that he also introduced the Oxford mispronunciation of it from not having learnt it from a Greek. *See* 1488. Wormwood is still used in beer.

1491. **France**—Increase of artillery; that used at Rennes is drawn by 3000 horses, but apparently even now light field artillery is not formed. *See* 1489, 1477, 1846.

1492. **Spain**—Expulsion of Jews by Fernando V. after the conquest of Granada; they had given financial support to the Moslems. Colombo the Genoese, who has made some discoveries about the declination and the variation of the compass, is despatched to make explorations; he discovers Guanahani, Cuba, and Hayti in his first voyage, and finds the natives wear cotton clothes.

1492. **England**—Standards of measure are set up in every town. Benevolences receive Parliamentary sanction.

1492. **Italy**—Pope Alexander VI. (Roderic Borgia) asks for Ottoman help in a war against France; this is the first Papal alliance with Moslems against Christians.

1493. **Germany**—The study of the Greek and Hebrew languages is introduced by Jo. Reuchlin (Capnio). *See* 1481.

1493. **Europe**—General appearance of the morbo gallico, in most large towns of Europe, but chiefly at Rome.

1493. **Spain**—Second voyage of Colombo in 1493-94.

1494. **England**—Printing is still carried on under protection, chiefly at Westminster Abbey. Attempt to enable really aggrieved persons to proceed at law gratuitously. 11 Hy. VII. c. 12.

1494. **Italy**—Friar Luca Pacciolo di Borgo prints the first algebraic treatise at Venice. Account keeping by double entry now begins.

1495. **Spain**—Conquest of Hayti, and settlement; the natives are made tributary, the tribute being a poll-tax of twenty-five pounds of gold dust. In 1496-97 Bartolomeo Colombo moves the colony from Isabella and founds S. Domingo, called Nueva Isabella.

1495. **England**—Music printing, a purely local invention, now begins. First forcible raising of benevolences, or taxes, for the public funds; defaulters are made liable to perpetual imprisonment; the firmness of the Government and the restoration of English power begins from this time.

1495. **Germany**—Rise of a voluntary association, termed the Landfriede, at the Diet of Worms, for suppressing civil discord.

Record of Progress

1495. **Italy**—Reputed date of the earliest comedy of Ludovico Ariosto of Reggio (b. 1474).

1495. **Russian Duchies**—German commerce is driven away by Ivan III., who plunders the stores of the Revel merchants at Novgorod.

1496. **England**—Gian Gaboto and his son Sebastian, Venetian residents in Bristol, but of Genoese descent, are employed by the king and the Bristol merchants to make explorations. They leave England in 1496, and on their first voyage in 1497 arrive at St. John's, Newfoundland, and thence visit the mainland, discovering and following its coast along Virginia down to Florida.

1496. **Portugal**—Nominal expulsion of Jews; but the blending of their race with the Portuguese prevents it from being carried out.

1497. **England**—*See* also 1496. Woollen stockings or knit hose are common in Scotland (Boethius).

1497. **Portugal**—The voyage of Vasco di Gama begins in 1497; he rounds the Cape of Storms discovered by Diaz in 1487, and visits Natal and Mozambique. In 1498 he discovers Zanzibar, and lands in Southern India at Kalikota, Kollam, and Kochi; afterwards joins in the wars of the Rajas of these places.

1497. **Italy**—Reputed date of the introduction of canal-locks on canals near Milan.

1497. **Illyria**—Quicksilver mines are discovered at Idria by a peasant.

1498. **England**—Second voyage of the Gabotos; they discover Prince Edward Island, Cape Breton Island, Labrador, &c., for the king and the Bristol and Plymouth merchants.

1498. **Germany**—Rifled firearms are known at Leipzig.

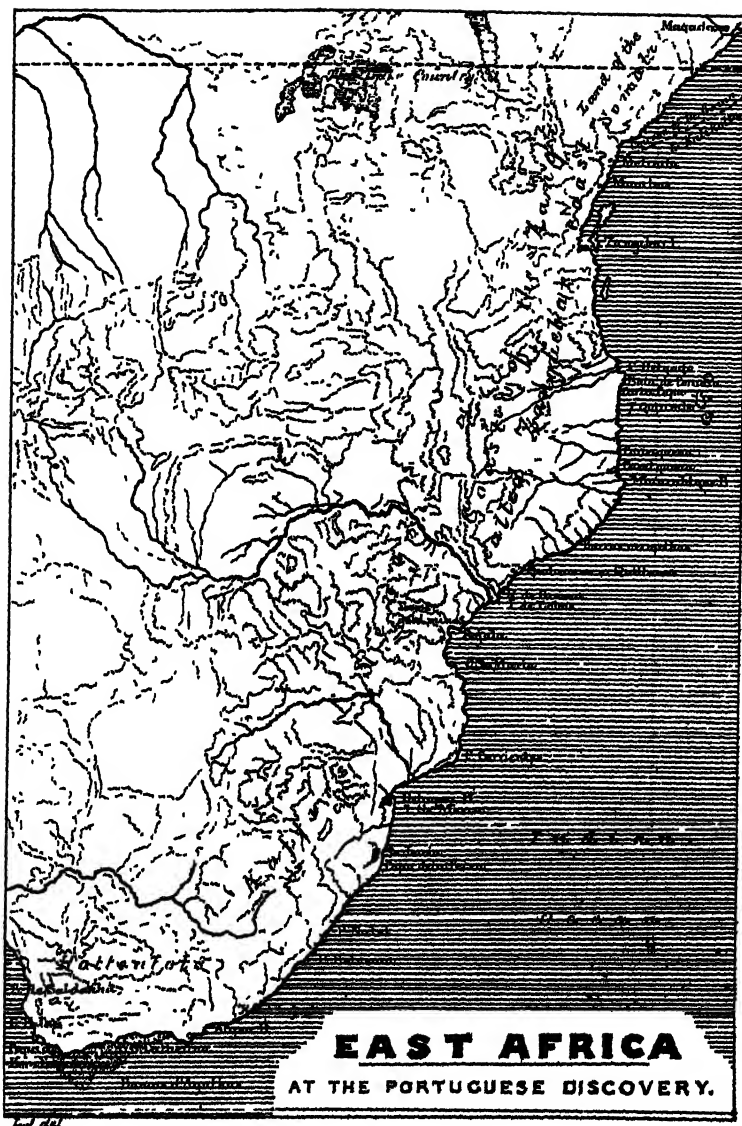
1498. **Spain**—Third voyage of Colombo; discovery of the continent of South America at the mouths of the Orinoco.

1498. **Portugal**—The Portuguese find that the use of cannon and fireships on a large scale is well known in Southern India.

1499. **England**—The Court moves to Calais on account of the plague. Probable date of the alteration of the costumes on English playing cards to those of the Yeomen of the Guard (instituted in 1486). *See* 1463, 1397.

1499. **Germany**—Speculative purchase of copyrights of books for printing and selling copies of them is introduced at Nurnberg by Johann Otto.

1499. **Russian Duchies**—Expedition beyond the Ural Mountains (Permia had only been annexed by Ivan III. in 1471). Attack on the Samoyedes, also on the Voguls and Ugrians; fifty of their princes are taken away as captives.



DISCOVERY IN SPECIAL BRANCHES.

Archaic Discoveries.

Apparently none of importance.

Chemical Separations, &c.

1413. Fulminating gold is discovered by Valentine.

1460. Alum, some knowledge of its uses are acquired in 1453 and in 1460 at the Papal dye-works.

1490. Antimony, its medical properties are known to Valentine.

1490. Cobalt ores, smalt, ultramarine, &c., known.

15th Century. The metals now known were those well known to the ancients, but the reduction of

ores of zinc had been forgotten; and platinum, known as electrum to the ancients, was also forgotten.

Soda and potash were still undistinguished.

Bismuth and phosphorus had not yet been separated.

Naturalistic Note.

14th Century. Supposed introduction of the peacock and of the guinea-fowl into Europe. (But the peacock was known in Spain in 1100.)

1374-1407. The Zharāf had been introduced in Granada from Timbaktu by Mensa Musa II.

EXPLORATION AND SETTLEMENT.

Western Asia.

1403-06. Embassy of Ruy Gonzalez de Clavijo to the Court of Timúr, perhaps at Tiflis.

1472-75. Embassy of Caterino Zeno as Venetian envoy to Persia and Arabia.

1480 c. Travels of Paolo Trevisano in Syria, Arabia, Egypt, and Ethiopia.

North Africa.

1415. English ships arrive in Morocco, and carry on commerce; first visit.

1415. Portuguese invasion of Morocco: Ceuta is taken.

1436-37. Second Portuguese invasion: Duarte is defeated at Tanjir. Eduardo restores Ceuta.

1459. Third Portuguese invasion of Morocco under Alphonso V. unsuccessful.

1471. The Portuguese attack and take Tanjir.

1495. Moors and Jews are expelled from Portugal and Spain.

Africa.

1402-05. Conquest of, in the Canary Islands, by Jean Béthencourt (re-discovered c. 1330, and visited in 1395). First settlement, conversion, &c.

1418-19. Voyage of Zarco and Tristan Vaz. They pass Cape Bojador, discover Porto Santo, and re-discover the Madeira Islands.

1430. Discovery of the Azores Islands by Van der Berg.

1432. Cabral visits the Azores Islands.

1432-40. Exploration of the African coast beyond Cape Bojador and Cape Blanco by Gilanez and Gonsalvez.

1445-46. Discovery of Cape Verde and Senegal by Dyan or Dines Fernandez.

1447. Exploration of the African coast beyond, as far as the River Gambia, by Lançarote.

1450 c. Antonio de Noli discovers the Cape Verde Islands.

1450 c. Luigi Cademosto, a Venetian, in the service of Portugal, visits or discovers the Cape Verde Islands.

1450. Settlement of Flemings and Portuguese at S. George's Island, Azores.

1450. First Portuguese settlement at Arguim.

1461. The fort of Arguim is now built.

1462. Discovery of Sierra Leone by Pedro de Cintra.

1471. Discovery of the Gold Coast by Santarem and Escobar.

1481. Fort El Mina, on the Ashanti coast, is built.

1483. Discovery of Benin by the Portuguese.

1484. Diego Cam, the Venetian, discovers the River Congo and Angola for Portugal.

1487. Discovery of the Cape of Storms by Bartolomeo Diaz.

1489. Second exploration about the Congo by Cam.

1490. Exploration about the coast near the Congo by Ruy de Souza.

1497. Vasco di Gama passes the Cape of Storms 19 Nov.

Exploration and Settlement

1497. He discovers Natal 25 Dec.

1498. Pable and Vasco di Gama discover Mozambique, and proceed to Southern India.

1499 c.(?) Journey of Duarte Lopez, ambassador from the king of Congo to the Courts of Lisbon and Rome. His map showed Lake Zambre (Tanganyika), and Lake Acque Lunda, to the west, as the source of the Congo; also south of the Equator the Lake of the Nile (Nyanza) and Lake Colue (?) (Ukerewe). Pigafetta published the account (1522-34).

South India.

15th Century. Travels of Niccolò de Conti in India for many years (25).

1487-. Expedition of Pedro de Covilham and De Paiva, for Joam II., from Lisbon, to discover the direct route to India. De Covilham went to El Kahirah and to Tor (near Sinai). Thence to Aden, Kannanur, Kalikota, and Gova. Thence to Mozambique and Sofala. Also to Zaila, on the Adel coast, on the Gulf of Oman. Thence to Aden, Ormuz, and back to El Kahirah.

1498. The Portuguese, with Vasco di Gama, land at Kalikota, at Kollam, and at Kochi.

1499. Vasco enters into the war between the Raja of Kollam and the Samuri of Kalikota.

China and Sunda Islands.

1405-06 to 1461. Chinese conquest of Anam, Burmah, and Ceylon by a fleet of sixty-five ships, under Ching Ho; they release Wijaya Bahu in 1411, and keep Ceylon tributary for fifty years more.

1490. The Chinese first learn of the existence of the Moluccas (Melloku).

1421. Last recorded visit of an Indian wakil or envoy to China.

1449 (?). Nicolo di Conti visits Sumatra.

North America.

1497. First voyage of Gian and Sebastiano Gaboto, of Genoese descent, but from Venice, and long domiciled near Bristol. They leave Bristol in 1496, for the King and the Bristol merchants. They arrive at Newfoundland (S. John's), and visit the mainland; then they go coasting south to Virginia, and near Florida.

1498. Second voyage of the Gabotos: discovery of Prince Edward Island, Cape Breton Island, Labrador, &c.

Antilles and Islands.

1492-93. First voyage of Colombo, from Huelva to Great Canary and Gomera, to S. Salvador (Bahamas) or Guanahani, 12 Oct. 1492. Thence to Conception (Bahamas), and Fernandina (Great Exuma), and Saometo (Long I.), to Cuba, 28 Oct. 1492. First to R. S. Salvador, then to R. Las Nuevitas del Principe, the Mounts Cristal and Moa, to Puerto del Principe and the archipelago of N. Señora, to Barracoa Harbour and the Cape Los Azules, all in Cuba. Thence, going to Hayti or Bohio, arrived at the Harbour S. Maria (or S. Nicolas), to Tortuga I. and Mosquito Bay; and back to Puerto de Paz, the Gulf of S. Thomas (Limbe). He left Escobedo at a fort on the coast of the province of Marien. Thence to the I. Monte Christo and the Golden River, Point Isabella and the coast to the Bay of Samana, at the east end of Hayti. He then went to S. Mary, in the Azores, to Lisbon and Puerto in Spain.

1493-96. Second voyage of Colombo, from Cadiz to Ferro (Canaries). Thence to Dominica, Mariegalante, Guadalupe and Madania, Montserrat, La Rondona, S. Martin and Santa Cruz, to the Virgin Archipelago, and I. S. John Baptist (Puerto Rico)

Exploration and Settlement

to Hayti. The colonists had been killed. Discovery of Port Royal, and of gold in the province of Cibao. The town Isabella is founded thirty miles east of Monte Christo and Fort S. Thomas, in Cibao. Thence to Jaymaca (called Santiago), 3 May, 1494, and an exploration of the Cuban coast. Again to Jaymaca, and to Isabella, in Hayti. Thence Colombo returned to Cadiz.

Antilles and Carib Islands.

1495. Conquest of the Island of Hayti by the Spaniards, and reduction of the natives to tribute.

1496-97. Bartolomeo Colombo founds the first town of S. Domingo, named Nueva Isabella, after removal from another site.

South America.

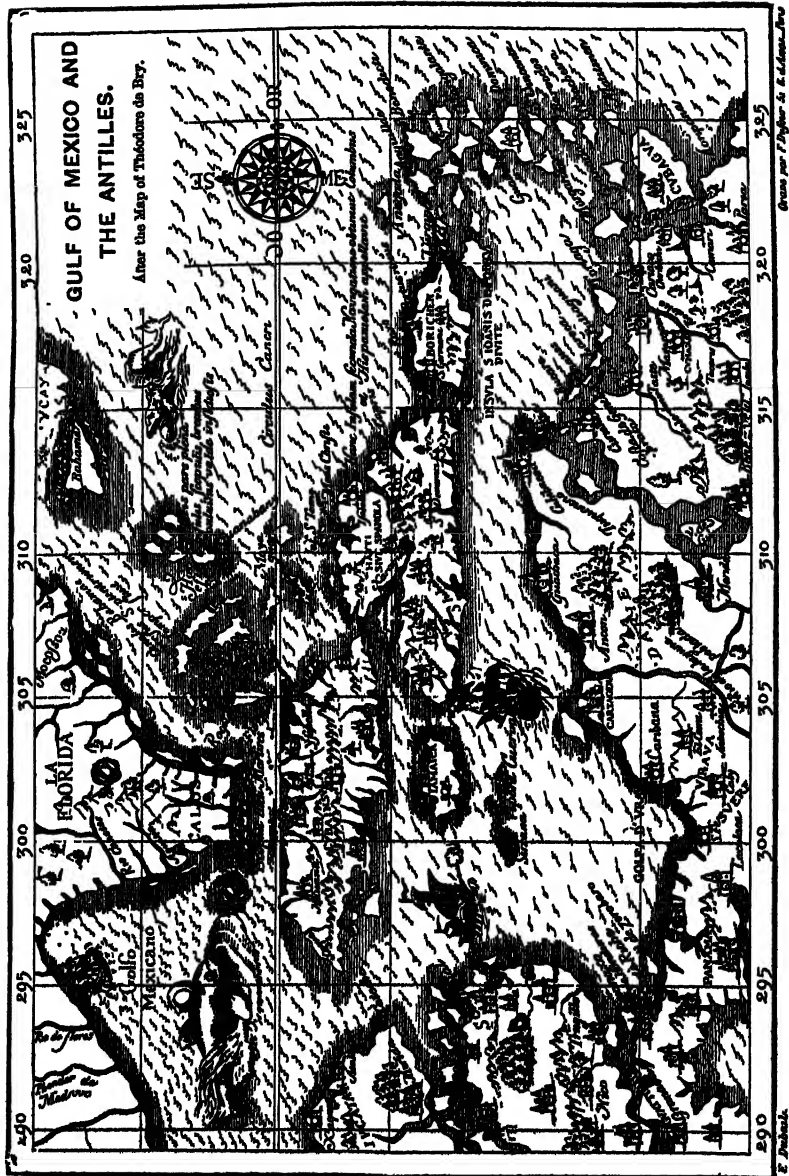
1498-1500. Third voyage of Colombo, to the C. Verde I. and the lat. of Sierra Leone. Thence

across to Trinidad, and to Gracia (part of Cumana), at the Gulf of Paria. Thence to C. Pera Blanca and C. Lapa, to the Port of Monkeys, near Point Cumana and Point Alcabraz. Thence by Dragon's Mouth Strait to Tobago I. and Concepcion I. (Grenada), Margarita I. and Cubaga I. to S. Domingo, a town newly built by Bartolomeo in Hayti. Thence Colombo was sent prisoner to Spain.

1499. Voyage of Hojeda, from Sa. Maria to Venezuela, S. Margarita, G. of Paria, B. de las Perlas, Dragon's Mouth Strait, to C. La Vela and the Carib I., to Yaquimo, in Haiti. Thence he returned to Cadiz with a cargo of slaves.

1499-1500. Voyage of Alonzo Nino, from Barra Saltez to the coast of Paria, for a cargo of pearls.

1499-1500. Expedition of Vicente Pinzon, to the coast of Paria, and following the coast from C. S. Augustine, S. lat. $8^{\circ} 20'$, to Rio Grande and C. S. Vincent.



SIXTEENTH CENTURY

1500 TO 1599.

PERIOD OF SPANISH SUPREMACY.

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SIXTEENTH CENTURY

1500 TO 1599.

PERIOD OF SPANISH SUPREMACY.

GENERAL DEVELOPMENT.

THE most marked feature among the general discoveries of this century is the large amount of geographical discovery in all parts of the world; in this the Spaniards and Portuguese, and the Italians in their service, were the leaders. The Netherlands were their followers in order of time and place, but discovered little; in this they were surpassed by the English. Much of the enterprise leading to these very numerous discoveries was borne by large private companies, an institution that was largely developed in this century. Similarly the large public lotteries, the forerunners of banks, were institutions of this period that enabled public works and buildings to be made.

The financial recovery of Europe generally was partly due to the suppression of the commercial monopoly of the Hansards. One country still suffered severely; Hungary was ruined by the Fuggers, who had both mining and commercial monopoly over the whole.

The astronomers of this century were few. The Emperor Maximilian employed Thaddeus Agesius as astronomer, but he was also a physician, and wrote on brewing. Tycho Brahe of Knudstorp made an armillary sphere, introduced refraction in his calculations, discovered a star in Cassiopeia in 1572, and carried on a series of observations from 1582 to 1601 or 1604. Nicolaus Kopernik, of Thorn, in Prussia, 1473 to 1543, proposed his new theory in 1530, after devoting his life to the subject. Girolamo Fracastoro of Verona, 1483 to 1553, invented a powerful telescope, made observations, and led up to the Kopernikan system; he also discovered the

compound nature of the secular variation of the obliquity of the ecliptic. Thomas Hariot, 1560 to 1621, discovered the Jovian satellites and the sun spots. Christian Longomontanus of Laensburg, 1562 to 1647, made tables of the planetary motions, but blended the Ptolemaic and Kopernikan systems. Gerard Mercator, 1512 to 1594, of Rupelmonde, made improved astronomical rings and instruments. Nicholas Raimarus (Urdus), a Danish astronomer, lived from 1550 to 1589. Ignazio Dante of Perugia, 1540 to 1586, made gnomons, new astrolabes, solar quadrants, laid down meridians, and made useful mathematical tables. These were probably the whole, and if many in comparison with those of the past, it must be noticed that private astronomers hardly existed.

Astronomical knowledge was fostered yet by very few public Observatories, and Botanical knowledge by a few public Physic gardens and botanical gardens; but the introduction of plants, shrubs, and trees from every quarter of the world, and from various European countries into others, a labour of private enterprise, were the chief means of promoting such knowledge.

Among the discovering botanists were also the following: Acosta of Mozambique, d. 1580, who wrote on Indian plants and drugs; Aldrovandi of Bologna, 1522 to 1605, who formed a botanic garden; Aloisius of Anguillara, who lived at Padua, d. 1570; Ruel of Soissons, fl. 1536; Brunfels of Strassburg, fl. 1530; Pierre Belon, 1517-1564, naturalist of the Levant and Egypt; Fabio Colonna of Naples, 1567 to 1600, who classified plants according to their seed and fruit in 1591; Konrad Gessner of Zurich, 1516 to 1565; Thomas Johnson of Selby, 1561 to 1644; Nicolas Monardes of Sevilla, d. 1578, who wrote on Indian plants and drugs; William Turner of Morpeth, 1520 to 1568; and Albert Seba, of East Friesland, b. 1565, who travelled in India, and made descriptive plates of natural objects, and wrote on drugs and plants.

Agronomy was also a new science; founded in Italy by Agostino Gallo of Brescia, 1499 to 1570, and in France, Olivier de Serres, 1539 to 1619, who wrote on field crops and mulberry planting.

Chemical science was confined to very few men, and received very little encouragement from Governments. Medical men and druggists were ignorant of it, and its rise was fostered more by its use in the treatment of ores of mining operations and the sale of the results of such treatment, than in any other way.

The last of the reputed alchemists of the old school was Van Helmont of Brussels, 1577 to 1644, who lived well into the next century ; thus showing the curious state of this branch of science. George Landmann (Agricola) of Chemnitz, 1494 to 1555, a metallurgist and chemist, wrote on the philosopher's stone—a very ancient Indian notion. Aloysius Anguillara was a chemist and botanist, but his works are lost. Sir Robert Dudley, 1573 to 1639, was a chemist as well as mechanist and scientist. Andrew Libau of Halle, fl. 1588, d. 1606, the inventor of a new caustic, and the first proposer of transfusion of blood, was a chemist. Aureolus (Paracelsus) Philip Theophrastus Bombast von Hohenheim, born at Einsiedlen, 1493 to 1541, hardly rose above the alchemists ; his pyrologic tests of substances were, however, a basis that might well have been followed up. A certain amount of chemical knowledge was used by Palissy the potter, and learnt by Neri, who wrote on glass-making. Ebener the metallurgist, d. 1577, may also have been a chemist.

The physicists of this century formed certain developments, which forecast to some extent the leading features of future European science, distinguished from the Moslem sciences hitherto developed anew. A multitude of branches of practical science on theoretical bases had never been worked out by the Moslem ; and it is on account of these numerous skilful ramifications that the Asiatic now respects the European scientists. The higher perfection of detail in the older sciences would doubtless have been equally well carried out by Asiatics under favourable conditions.

It is of course impossible to mention here all these new branches ; but some of the doings of the European physicists of this century will be indicated. Guillaume Bude of Paris, 1467 to 1540, was to some extent a scientist. Dante of Perugia wrote on anemoscropy ; Napier wrote on rhabdomancy ; Francesco de Marchi of Bologna, fl. 1530 to 1570, proposed twenty-eight systems of fortification, afterwards used by Vauban. Fra Sarpi (Polano) made magnetic observations ; Antonio Serra, b. 1550, wrote on currency and on political economy. Simon Stevens of Bruges, a civil engineer and mathematician, discovered the weight of air. Ramelli of Milan, 1531 to 1590, wrote a work on machines with 195 descriptive plates. Buon-talenti of Florence, 1536 to 1608, invented several machines for raising weights and water ; also Alberti ; Ralph Aggas, d. 1579, made plans of large towns ; G. B. Porta of Naples,

1540 to 1615, wrote on optics and refraction, was the reputed inventor of the camera obscura (known to Alberti of Venice, 1404 to 1472, also to Bacon), and wrote on pneumatics, mnemonics, cryptography, and natural magic. Niccolò Tartaglia of Brescia, d. 1557, the inventor of analytic geometry (developed more by François Viète), and a great mathematician, wrote on the motion of projectiles, used a diving-bell (known to the Greeks and ancient Indians), and employed a crane for raising a sunken ship or boat. Such things as correct chronometers, and pocket watches, engraving on steel as well as on copper, music printing by stencil, rifled firearms, and whale fishery, form, with the preceding, a very significant indication of a variety unknown to, and uncared for, by the Asiatic,—that belongs to this century. When we look at the bareness of the preceding five centuries in such things, and the hitherto comparative monotony of the past range of discovery and invention, it becomes clear that the difference is not accounted for by absence of record, or very defective information about earlier doings. That would hardly account for a third of it. Development was formerly cramped and confined to old lines; it now became more free, and in some special cases was encouraged by governments, as in improved chronometers, and in aquaregia; but nothing like the Oriental system of rewards and encouragement to scientific men for deeds done, discoveries made, and books written, was adopted by European kings. Such deeds were usually charitable gifts made gratuitously to the nation by suffering and laborious men; it seems wonderful that so much was done, and wonderfully foolish of rulers and nations not to have caused a hundredfold more to have been done earlier.

The various private collections of plants, minerals, and objects of natural history were a new feature in this age, and did much to extend knowledge; for the more ancient monastic museums did not have such things, but held curiosities often quaint and valuable, also of a saintly character, but seldom scientific or instructive.

Mathematics now received its great starting incident that led to its modern development afterwards. The revival of algebra as useful knowledge followed the Italian discovery of Scipio Ferro, that solutions of useful questions could be done with it. Geology also rose as a science after Fracastoro studied his collection of fossils.

The discoverers in anatomical science during this century
(158)

were naturally, as hitherto, Italians. They were:—Aranzio of Bologna, 1530 to 1589; Canani of Ferrara, 1515 to 1579; Carcano of Milan, 1536 to 1606; Casserio of Piacenza, 1545 to 1616; Cesalpino of Arezzo, 1519 to 1603; Colombo of Cremona, fl. 1544 to 1559; Fabrizio of Acquapendente, 1557 to 1619; Eustacchio of San Severino, 1510 to 1574; Falloppio of Modena, 1523 to 1563; Guillemeau of Orleans, 1550 to 1586; Ingrassia of Palermo, 1510 to 1603; Paré of Laval, 1510 to 1590; Ruini of Bologna, fl. 1598; Sarpi, called Polano of Venice, 1552 to 1623; Michael Servetus from Aragon, 1509 to 1553; James Silvius, French, 1478 to 1555; Tagliacozzi of Cologne, 1546 to 1599; Vesalio of Brussels, 1514 to 1564; and lastly, Thomas Vicary, English, fl. 1548.

Out of them five discovered the venous valves and the circulation of the blood. In fact, the bulk of human osteology and myology was done and tabulated by Italians in this century. Other nations might be grateful to them for being thus spared many unpleasant tasks; for invaluable as anatomical knowledge is to surgeons, physicians, and artists, the anatomists themselves were not necessarily better operative surgeons or physicians; and even the practically anatomic artists did not learn from dissection the higher anatomy useful in art—that of motion, expression, character, and mental feeling and quality. Yet the valuable basis for higher development in every respect was due to Italians; the dissection of the corpse was the prelude to the mental analysis of the human being, both from a surgical and an artistic view.

Veterinary science began with Ruini of Bologna in 1598, who dissected horses and wrote on their diseases; his work was reproduced in the book of Snape, the first English veterinary surgeon with anatomical knowledge.

This was specially the age of beginnings of various sciences, and the mere knowledge of their existence was confined to very few. The numerous colleges, universities, large schools, and free schools chiefly taught the ancient languages, ancient authors, Latin and Greek, and literary knowledge. Latin was still the language of books, and of past historical matters, and a knowledge of it was necessary for a student of any sort; yet it was not made the means to an end, but the end itself; hence the excessive ignorance of everything that resulted from such education. But, on the other hand, literature during this century took a large and new development, through the

dramatists. Comedies were written in every country, and in the local language. The public libraries of this age, really open to the public freely, were few; a few town-libraries existed, but most of them were attached to universities, or controlled in some way, often by ecclesiastics. The academies, or associations for the furtherance of special branches of learning, began in Italy in this century; they were free from priestly control, and admitted valuable discussion of matters that were not suited to the public ear; but such academies were yet very few, and the protection of the progressive and scientific was hence very little. Even in England, with its historically free tendencies, there was a law in 1553 that all books on astronomy and geometry should be burnt as magic; and the magicians of this class were doubtless not well treated.

Construction and building took several new forms of development in this century. Not only were many towns, and even new capitals, built; but their fortification became a science, and fortresses were larger than before, and carefully designed, instead of being merely a continuous wall and moat, with a comparatively small keep as a citadel. The new style was developed by three men—Sanmicheli of Verona in 1527, who adopted angular bastions; Tartaglia of Brescia, who adopted the covered way, and died in 1557; and Francesco de Marchi of Bologna, 1530 to 1570, who invented barbicans or tenailles, demilunes or ravelins, lunettes, counter-guards, and proposed twenty-eight systems of fortification. With minor modifications these methods satisfied Europe till Coehorn and Montalembert introduced novelties. In engineering works, a few canals are constructed in most European countries, while in England larger waterworks and conduits are the special features, besides dockyards. Lighthouses, harbours and breakwaters are made or improved in England more than other countries, and their development belongs to this century; while large stone bridges of an ornamental character are chiefly Italian and French. Among buildings, castle-building of the old sort ceases; but halls, townhalls and palaces, and a few exchanges, large hospitals, and public buildings, are a new development. Large churches and cathedral churches are built on a larger scale, and in greater numbers, than before, throughout every country of Europe; also buildings for schools and colleges. In mechanical construction, saw-mills seem the new feature in most countries, but not in England, where large

engines for raising water are the novelty. Improved ship-building, and the manufacture of firearms in larger numbers, are noteworthy also throughout Europe.

This was pre-eminently the century of development of the Fine Arts in Europe, in almost every branch.

In Music, the names of two composers, and perhaps a few more of the last century, have survived, but in this century the names of the founders of modern musical composition become more numerous; they are these:—

A. Willaert, early sixteenth century, founder of the Venetian school of music; followed there by Giuseppe Zarlino, 1519 to 1599, who wrote church music and canzoni; and C. Merulo, fl. 1574, also at Venice; Claudio Monteverde of Cremona, b. 1565, died at Venice, and probably was of that school. Andrea Gabrielli, 1520 to 1586, wrote organ music; and apparently organs had only been re-introduced or restored in Italy very lately. Alfonso della Viola wrote operatic music in 1554; Ruggiero Giovannelli, both lyric and sacred music, 1560 to 1620 c.; Giovanni Palestrina, 1529 to 1594, wrote sacred music; Giulio Caccini, called Romano, flourished at the close of this century. In 1540 the earliest school of makers of violins began under Andrea Amati at Cremona; the art of manufacture was borrowed from English makers of fiddles by some Italian musicians in the band of King Henry VIII. F. D. The first concerts of the *Filarmonici* at Vicenza took place in 1565.

Beyond Italy, there was Orlando Lasso of Mons, b. 1520, who composed sacred music; also Beaujoyeux, called Balthasarini, who flourished in 1581. In England there were four noted composers: John Dunstable; Thomas Tallis, 1529 to 1585; Christopher Tye of London, fl. 1550; and R. Tarrant, fl. 1585, all of whom wrote antiphone and sacred music more and other music less. Morley's book of Madrigals was published in 1594, and there were many composers of madrigals, glees, and catches, the forms of lyric popular in England. A short lyric melodrama, called an interlude, also existed in England, but the full dramatic opera and the oratorio were probably still confined to Italy. The English fiddles were still the best, but the wood for making them was falling off in quantity during this century, till none remained. As to the quality of the singing in England at this period, there is every reason to believe that it was quite as good as that in Italy of the same time; and probably remained so till the Brownists

and Puritans gained the ascendancy, and instituted coarse drawing of psalms in a gloomy way as a substitute for better music. Strange infatuation !

In Painting and in Sculpture this was a triumphant century in Italy ; nothing elsewhere was nearly as good, though the Flemish painters were next best, and other nations were very far from these again. The culminating success in Italy was due to several causes :—A steady development for three centuries under scholastic successions, the study of anatomy by sculptors and painters, and perhaps some small assistance from a photographic process, which was kept secret ; also the study of the Greek antique sculptures found at the beginning of this century ; and the great and steady encouragement of fine art by ecclesiastics and lay patrons. None of these advantages were to be found elsewhere ; and at no other time was exactly the same combination of conditions available. Apparently there was only one disadvantage ; few Italian painters yet knew much about perspective ; Barozzi (Vignola), 1507 to 1573, and Lomazzo, 1538 to 1600, had not yet written on perspective in the early part of the century ; and apparently the Italians had not translated Peckham's work on that subject. Yet the knowledge preceded the writing about it, and some possessed that knowledge, though it had little bearing on the specially high branch of art, the depiction of the mental and moral qualities of the human being in figures.

Considering Buonarroti as the fullest developer of sculpture, and Sanzio of pictorial art, it seems clear that their individual skill was only one factor in the great combination that allowed it to be expended and employed in such a way as to arrive at a climax in each case. The same men, born a century earlier or later, or in any other country, with the same amount of original skill or native genius, would not and could not have produced similar results. A century earlier the knowledge of anatomy was not available ; and if we imagine that the doings of a school must necessarily be progressive, and search for any one with greater success than they had in the century following, they are not to be found on the roll of fame. One of Sanzio's pupils did many things in Spain much like those of his teacher, but this did not continue after him ; retrogression began, a climax had been reached. The conditions, rather than the individual genius, were on the wane ; and the progress of Fine Art, more than that of other things, depended on conditions. There were in Italy a hundred good painters and sculptors,

while in England there were perhaps five, if More, Oliver, Hilliard, and painters of that class be deemed good; and the Netherlands had about twenty-five of undoubted merit; while Spain had perhaps sixteen painters of a high order, chiefly instructed in Italy; and the French had only begun to follow Birtolomeo, Rosso, and the Italians in the same way.

Poetry revived in this century, and Dramatic works became numerous in local languages. It was the age of drama. The epos still existed; *Ercilla y Luñiga* made an epic on the Araucanian war, Camoens on the Portuguese Expeditions to Southern India. In England the early dramatists were Kydd, Heywood, Fletcher, Marlowe, Marston, Peele, Edwards, and collectively were as good as those of the two other nations that had preceded them, Italy and Spain. The Spanish poets of this time were Jaureguy y Aguilar, Garcilaso de la Vega, Lope de Vega, De Gongora, Herrera, Luis de Leon, and in pure poetry seem to have surpassed the Italian poets by far in quality though the latter were very numerous. The Italians were leading the way in lyric drama, as shown by the production of 'Orfeo,' 'Il Sacrificio,' and 'Aretusa,' and probably simple comedy was thrown in shade, though it certainly followed the other. The Romancists and panegyrists of the old school hardly existed, for chivalry of that sort had fallen under the satiric writings of Miguel de Cervantes Saavedra, of Alcalá, 1549 to 1616.

POLITICAL CONDITION.

The political condition of most European countries was not very favourable to progress. This was a century of Spanish supremacy, following on the union of the Spanish kingdoms and the downfall of the Moors, and strengthened by union with the Empire of Germany. Spain was ascendent over nearly the whole Continent. At one time France had to struggle for existence, at another time England; but Portugal fell and was annexed, though the Netherlands gained independence. Russia was emerging steadily from subjection to the Mughals. Poland was generally in a state of civil dissension. The great military achievement of the Empire was the series of wars against the Ottomans, and their expulsion from Hungary; this was the great disturbance of the peace of Europe from without. The other hindrances to progress were the wars of religious leagues, that convulsed Europe. England suffered less than other nations from both of these disturbing causes—the Ottomans and the religious troubles. Reformation was no novelty in England, and the people were generally Wycliffite in notion, without much love of Lutheranism or Calvinism; though opposed to priestly and papal domination, and hence abetting in similar opposition, they generally held aloof from the European turmoil. Their continuous naval opposition to Spain consisted in harassing and seizing Spanish colonial towns, while they sustained no attacks beyond that of one Spanish Armada. The whole was favourable to England, and enabled her to recover a position she had lost in the century before.

France, after fruitless campaigns in Italy, was torn with civil and religious war. Germany gained by political union under the Austrian dynasty. Denmark, Sweden, and Norway were torn by political dissension and wars of union and disunion. Italy was fortunate in suffering less than other parts of the German-Spanish Empire from religious difficulties and wars; it had some Socinians, and the Spaniards dealt severely with a few sectarians in North Italy; but the whole did not cause great or continued distress. The wars of the Empire against

France affected the Italians seriously : also the petty wars of their towns and states.

Hungary, with all its provinces, Transsylvania, Servia, Croatia, Slavonia, was conquered in 1529 ; and Hungary proper alone was entirely freed in 1570 from the Ottomans ; the rest of it was retained by the Ottomans, except Croatia and Slavonia, recovered only in 1699 ; Servia was disputed land for centuries, Bosnia also ; Wallachia and Moldavia were never regained by Austro-Hungary. Pohlen suffered both from Hussite and Calvinistic difficulties, and from the Ottomans in the Hungarian wars of 1526 ; but recovered at the close of the century from its constitutional and political broils under a Swedish dynasty ; but it had adopted the fatal principle of elective monarchy.

In the Russian duchies, now united under the dynasty of Rurik, the series of defeats and expulsions of the Mughals secured independence ; there were also some wars against the Polacks, in which the Russians maintained their position.

Spain, becoming isolated at the end of this century, gradually lost her supremacy afterwards.

As to the civil broils arising from plots and rebellions, Europe suffered little from them in a direct sense, for such matters were blended with or fell into the greater matters of religious or political war in states and territories. The two most factious and rebellious nations of the period were France and England. France was in perpetual turmoil for a long time. There were seven serious rebellions in England during the century ; and Scotland was seldom free from plot and revolt. Flodden Field was fought early in this century, and the Irish revolts were seldom very serious. The Tudors reigned with the help of firm and able Ministers, and difficulties were soon overcome.

Sickness and famine were less desolating in this century than in the last ; in Europe generally, also in England. In Italy there were several severe visitations of plague—some in South and Middle Europe, and in England only two, both in Northumbria, during the century. The famines from scarcity of crop and produce can be traced with difficulty, some of the dearths following war or plague, and being due to them.

Beyond Europe, Spain met with little difficulty in her American conquests ; the Antilles, Mejique and Peru fell easily to her ; in Chile and in La Plata she was severely checked. The Portuguese, everywhere successful on the African coasts

and in Ceylon and Sunda Islands, were strongly opposed in India. The English went to discover and declare possession rather than to conquer; and their settlements, merely for coast trade, were very few, even at the end of the century. The Netherlanders usually followed late in the wake of the Portuguese, and seldom fought. At the end of the century the Russians conquered Siberia and formed settlements after very little opposition from the remains of Mughal power. The Venetians lost their Asiatic commerce. Though the Portuguese were not successful in acquiring very much of it, they certainly held it till the annexation of Portugal to Spain, and the intervention of the Netherlanders and the English. Levantine commerce ceased to be exclusively Venetian about 1500, and was divided among maritime European nations. Though the purely political condition of Europe was not good, this was a century of rising financial prosperity and enterprise, which accounted for almost all the progress achieved. But the pre-eminence of Italy as the leading progressive and inventive nation began to decline from these causes.

RECORD OF PROGRESS AND EVENTS

1500 TO 1599.

PERIOD OF SPANISH SUPREMACY.

1500. **England**—Merchants begin extensive commerce with the Levant about this time.

1500. **France**—Descharges invents port-holes in ships of war ; yet apparently does not make any in France, but applies his invention in England. *See* 1545.

1501. **Spain**—Gonzalvo de Cordova introduces improved military tactics, and uses them with success in the Neapolitan campaign.

1505. **England**—Reputed re-introduction of spinning by distaff, by Bouvise, an Italian ; probably some new application of a very ancient method.

1505. **Germany**—Sigismund von Maltitz invents wet-stamping of ores in Saxony.

1505. **Italy**—Scipio Ferreo of Bologna solves some questions algebraically ; the revival of algebra in Europe now begins. It was introduced by Bonacci of Pisa in the thirteenth century. *See* also 1494.

1506. **Spain**—Discovery of the Newfoundland fishing grounds by Biscayans. *See* 1389. Sugar-canes brought from the Canary Islands are planted in Hayti.

1508. **Spain**—Beginning of agricultural slavery in Hayti ; Africans are brought to grow sugar-cane, probably from the Portuguese slave-depôt at Argum on the Guinea coast, which had existed since 1454.

1508. **Italy**—The comedy of the Calandra, by Bibiena, is performed at Venice. *See* 1495.

1509. **England**—The first two-decked ship of war of 1000 tons, but apparently without any port-holes, is now built. *See* 1500. First arrival of Flemish gardeners, who grow vegetables of sorts that had hitherto been imported from Flanders ; an import that now declines.

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1509. **Germany**—Several ornamental coaches are used by women on the occasion of a great tournament at Ruppen, in Brandenburg.

1510 c. **France**—Le Comte, who uses aquafortis, now discovers aqua regia; his discoveries are eventually bought by the government; an early case of encouragement.

1510. **Germany**—The first known large private collection of objects of natural history is now formed by Agrippa at Koeln.

1512. **England**—First arrival of gypsies. Horse-racing is established at Chester. *See* 900. Mercury is now largely adopted in medical practice as a remedy for every disease; probably a mode introduced from Germany.

1512. **Spain**—Fernando V., el Catolico, first appoints resident ambassadors to various countries, instead of merely sending envoys on occasions.

1513. **Netherlands**—The first printed treatise on midwifery now appears; it was probably written or issued by Eucharius Roesslin.

1513. **Italy**—The ancient Etruscan art of enamelling, or painting in enamel, is revived.

1515. **France**—Italians from Milan begin silk industry and fabric at Lyons.

1516. **Hungary**—At this time shortly after the accession of Louis II., a small boy, as well as before it, the Court is in penury; no revenue reaches the king, but the Fuggers control all commerce in the country, and are owners of all the mines; they revel in wealth. Yet Protestants are massacred under Bathory, and the Ottoman envoys of Sulman are mutilated in 1521. The whole accounts for the conquest of Hungary in 1526.

1517. **Italy**—Fracastoro studies fossils and begins the science of geology. He uses a telescope, perhaps the first.

1518. **England**—Introduction of fireworks and of Oriental porcelain; both probably come from India through the Portuguese, and not direct.

1518. **Germany**—This date is assigned to some works of Albert Dürer of Nürnberg, that show improvements in wood-engraving, also a knowledge of steel-engraving, etching, and various pictorial processes hitherto unknown. *See* 1450.

1518. **Spain**—Large development of sugar growing and factories in Hayti. *See* 1506 and 1508. Mexican cochineal is introduced into Spain as a dye, and afterwards becomes generally adopted in Europe instead of the Turkey dye for scarlet.

1519. **Germany**—Ore-stamping mills are now first constructed by Paul Gromestetter of Schwartz.

1520 **England**—Improved sea-charts, probably of foreign navigators, are now used. Vegetable gardening in the Flemish way is now greatly extended; most of it under the direction of immigrant Netherlands. *See* 1509.

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1520. **Germany**—Beginning of the Lutheran reformation, and excommunication of Luther.

1520. **Spain**—The cacao plant and the Mexican prepared chocolate are now imported, and the beverage chocolate is introduced.

1520. **Italy**—Rise of the Roman school of pictorial art, founded by Raffaele Sanzio. Rise of artistic ornamental pottery. *See* also 1513. Yet Moorish majolica ware itself had been introduced and well-known in the twelfth century.

1521. **England**—Discovery of whalebone at Cape Breton. *See* also 1506 and 1388. Brass cannon are now made locally, probably for field-pieces only.

1521. **Germany**—The Imperialists use the arquebus at the siege of Parma.

1522. **France**—Rise of a French school of pictorial art, originally through Bartolomeo.

1522. **Spain**—First voyage of circumnavigation of a ship commanded by Magalhaens, in the Spanish service.

1523. **Italy**—The earliest bastions are made at Verona by San Micheli; they replace the small half-towers before used to flank the simple walling of fortresses.

1524. **England**—Soap is now made at Bristol and at London in large quantities. Artesian hops are now grown in England. Date of the reputed first introduction of turkeys.

1525. **Spain**—Muskets, strictly so termed, are now first used at the siege of Pavia; but hand cannon of some sort had been largely made at Perugia in 1364, and had been used in England in 1370.

1527. **Europe**—Lutheranism now extends to Denmark, Norway, Sweden, and Holland.

1527. **France**—A guild of knitters of worsted stockings is now first mentioned.

1527. **Italy**—First establishment of Letters of Health by consuls of various European commercial nations (according to the date of Zegata). Their aim was to lessen the spread of the plague or sweating sickness that ravaged Europe, and had probably come from China with the Portuguese, who had been entirely expelled by edict.

1530. **Norway**—A saw-mill, driven by water power, exists at this time. *See* 1322.

1530. **Netherlands**—A chronometer for ascertaining relative longitude is proposed by Gemma Frisius; it is described in Carpenter's 'Geography' in 1685.

1530. **Germany**—Otto Brunfels, of Strassburg, writes his 'Herbarum vivæ Eikones,' and revives botany as a science. Zinc is mentioned by Paracelsus, calamine being known to him; but zinc was apparently a lost metal, though known to the Anglo-Saxons, and to the Indians before them. George Agricola discovers bismuth. The spinning-wheel is invented at Nürnberg, and replaces spindle and distaff. Nicolaus Kopernik completes his treatise on the revolution of heavenly bodies.

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1530. **Spain**—Knitted silk stockings are now made ; some are sent abroad or exported.

1531. **Germany**—Johann Gottlieb introduces account keeping by double entry at Nurnberg ; it was of Venetian origin. *See* 1494.

1532. **England**—The cultivation of hemp is now much extended by royal order ; it was introduced in 1139, but had fallen into the hands of men of very low class.

1532. **Germany**—Simon Grynoeus, the editor of many works of Greek authors, now issues a work on cosmography, that includes the latest discoveries.

1533. **England**—Revival of improved husbandry, following improved vegetable gardening. Entire abolition of Papal interference in national matters.

1533. **Germany**—A wheel for spinning flax is invented at Brunswick. *See* 1530.

1534. **England**—Institution of a National Church governed by a primate appointed by the king ; this institution was accepted in Ireland in 1535.

1534. **Holland**—Jewish sabbatarianism first appears among European Christians, being introduced by a sect of Anabaptists ; it afterwards spreads greatly.

1534. **Portugal**—De Gama uses an astronomical ring as a combined substitute for the astrolabe, quadrant, and cylinder ; he gives one to the secretary of the king of Hungary.

1535. **France**—Spirit-rapping is practised by some monks at Orléans, as a device for obtaining money.

1536. **France**—Ruel of Soissons writes his 'De natura Stirpium,' and revives the science of botany. *See* 1530.

1536. **Italy**—Gazettes of war news are issued now during war time. Monthly newspapers, termed 'Notizie veritte,' appear first at this time.

1538. **England**—Robert Brook re-introduces leaden water-pipes.

1538. **Spain**—Some Greeks use a diving-bell in the river at Toledo before a large number of spectators and in the presence of the king and court.

1539. **Spain**—First discovery of gold mines in Chile.

1540. **England**—The Bavarian spinning-wheel is introduced. *See* 1530 and 1533. The first tolerably good public clock now exists at Hampton Court Palace. Copper-plate printing exists in a book, 'The Byrth of Mankynd.' *See* 1518. Date of the earliest English comedy, 'Ralph Roister Doister,' by Udal. *See* 1495. Gaboto, a Venetian of Bristol in the English service, makes some further discoveries about the variation of the compass. *See* 1492.

1540. **Germany**—Val Cordus completes a large private collection of plants and minerals. *See* 1510. Apparently the first one.

1540. **Italy**—Rise of the earliest violin school at Cremona under Andrea Amati ; the improved violin was thus Italian, but the

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original was the English fiddle introduced into Italy by some returning musicians of the band of King Henry VIII.

1540. **Italy**—Etching is invented or introduced by Parmegiano. *See* 1450 and 1518.

1542. **Germany**—First general pharmacopeia of Nürnberg : probably the first in Europe.

1543. **England**—Improved ornamental gardening begins at Nonsuch Park, Ewel. Account-keeping by double entry introduced by Hugh Oldcastle. *See* 1494, 1531. Iron cannon of home manufacture are now cast in Sussex, and mortars are now first made in England. *See* 1343. Pins are introduced from France.

1543. **Germany**—The writings of Nicolaus Kopernik, improving the Pythagorean system, are now published. *See* 1530.

1543. **Portugal**—Notice that gold fish-hooks are used by the Brazilian Tupi tribes.

1544. **England**—News-books or occasional news sheets appear now. Pistols are adopted for horse soldiers. Tapestry manufacture is re-introduced by Sheldon ; it had been carried on in Flanders for three centuries, though of Oriental or Moorish origin. Sugar refining is now done locally, instead of at Antwerp, where it had lately been done. It was an industry known in 1329.

1544. **France**—Reputed date of the existence of a corps of pistoliers, or cavalry carrying pistols.

1545. **England**—Portholes in warships are now adopted, after the design of a Frenchman. *See* 1500.

1545. **Netherlands**—Date of the adoption of bastions at Antwerp ; an Italian invention. *See* 1523.

1545. **Germany**—Beginning of the book trade of Leipzig, that afterwards became immense.

1545. **Switzerland**—Konrad Gessner of Zurich writes the 'Bibliotheca Universalis,' one of the earliest European catalogues of books in Greek, Latin, and Hebrew.

1545. **Spain**—Large discoveries of silver at Potosi. More gold is found in Chile. *See* 1539.

1546. **England**—Blank verse is first adopted among English poets by the Earl of Surrey.

1546. **Germany**—Agricola Landmann has a catalogued collection of minerals. *See* 1540.

1546. **Spain**—Reputed date of the discovery of the circulation of the blood ; Michael Servetus of Aragon, 1509 to 1553, has the first claim. The other reputed discoverers of it were Realdo Colombo of Cremona, who taught it 1544 to 1546, and died in 1559 ; Canani of Ferrara, 1515 to 1579, who discovered the venous valves ; Andrea Cesalpino of Arezzo, 1510 to 1603, who knew both the greater and smaller circulation ; Fabrizio of Acquapendente, 1537 to 1619, who mentioned the venous valves ; Andrew Vesalius of Brussels, 1514 to 1564, public lecturer, 1540 to 1544 ; and Fra Paolo Sarpi of Venice, 1552 to 1623, fl. 1588. Popularity assigns it to the last, and least likely.

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1546. **Italy**—Rise of Socinianism in Italy ; it afterwards spreads to Germany and Poland.

1547. **Denmark**—Henry Rantzau erects the first saw-mill in Holstein. *See* 1580.

1548. **England**—William Turner writes the earliest treatise on ornithology ; it is published at Koeln. Thomas Vicary writes one of the earliest English treatises on anatomy ; hitherto the works on anatomy known in England were the books of Galen (A.D. 130), the Latin works of Mondino of Bologna, 132 c., and the Latin work of Achillini of Bologna, 1512 B.C. ; perhaps also some later work of Italian anatomists. Even in France there was already an anatomist, James Silvius, 1478 to 1555.

1549. **England**—Suppression of image worship, introduced in Europe in the seventh century.

1549. **France**—Publication of the Caroline books, iconoclastic, and opposing the Nicene decrees ; it is supposed they were written by Alcuin for Charlemagne, and were used at Frankfort in 794.

1550. **England**—Iron cannon-balls and bullets are now used ; they replace stone balls and leaden bullets.

1550 c. **Netherlands**—Simon Stevin of Bruges, civil and mechanical engineer and mathematician, adopts numerical exponents, and determines the weight of air.

1550. **Germany**—Hans Lobsinger, living at Nurnberg, gives a catalogue of machines to the magistrates ; perhaps none of them were of his own invention.

1550. **France**—Edict of Henri II. against noxious and innocuous adulteration of saffron, by adding to or altering its weight, as such practices were harmful to French commerce.

1550. **Italy**. The Umiliati, a wealthy sect of Benedictines, who carry on woollen manufacture, are disendowed, and forced to return to monastic rule ; afterwards they are entirely suppressed.

1551. **England**—Turner publishes his 'New Herbal,' 1551 to 1568, and revives botanical science. *See* 1580. Attempt to restore viticulture in England, beginning by planting some foreign vines at Braxhall, in Suffolk.

1551. **Germany**—Konrad Gessner publishes the first part of his work on zoology. *See* 1545.

1552. **France**—Performance of the earliest French comedy 'Le Rencontre' of Jodelle. *See* 1495, 1540.

1553. **England**—Robert Chancellor discovers the sea passage by the North Cape to Arkhangel, and establishes a factory there, or small English colony.

1553. **Germany**—Ebener discovers the use of refuse furnace calamine in making brass. *See* 1530.

1553. **France**—Belon the traveller writes a work on Ikhthyology.

1553. **Italy**—Marius Nizolius, the grammarian, issues his 'De veris Principiis,' and founds the modern school of logic.

1554. **England**—Sealing-wax is introduced in London from the

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East, probably from India; it is afterwards used in Europe generally, and termed lac, or Spanish wax.

1554. **Germany**—Light field-guns are used by Charles V. at the battle of Remi. *See* 1521. Alum works are started in Hesse, afterwards in Bohemia.

1554. **Italy**—The pastoral drama 'Il Sacrificio,' probably the earliest thing of this sort, written by Agostino Beccari of Ferrara (d. 1590), with music by Alfonso della Viola, now is performed. Tartaglia of Brescia, the mathematician, proposes the covered way, to form an outer line of defence in front of the ditch of a fortress. *See* 1523, 1545.

1555. **France**—A saw-mill now exists at Lyons. *See* 1530, 1547.

1556. **France**—Bernard Palissy makes improved crockery and earthenware, probably on the basis of Oriental porcelain, and of the new Italian pottery. *See* 1513, 1520, 1518. The ordinary French crockery was that of Beauvais, as in the 13th century.

1557. **England**—Glass vessels and bottles are now made locally at Crutched Friars, London; window-glass is also made locally in greater quantity.

1557. **France**—Gobelun's dye works are established at Paris; his new scarlet dye is an Oriental or Turkey scarlet brought and made by Klock or Koek, a Flemish panter who had travelled in the East.

1559. **France**—Silk stockings, now rare, are first worn by Henri II.; probably they were brought from Spain. *See* 1530.

1560 c. **Netherlands**—Ferdinand de Launoy, Fleming, born in Italy, and governor of Artois, Holland, &c. (d. 1579), invents mountain batteries. He also makes the first topographical maps of large districts, Franche Comté and Bourgogne.

1560. **France**—A corps of carbineers, light cavalry armed with carbines, is raised. *See* 1544.

1561. **England**—Silk-weaving is introduced at Sandwich by Flemish immigrants.

1561. **Germany**—Lace-knitting, which was possibly invented in Saxony, is practised there by the families of miners.

1562. **England**—A guild of embroiderers is incorporated.

1562. **Netherlands**—Rise of musical bell-ringing; Peter van den Gheyn sets up a carillon at Louvain.

1562. **Italy**—Venetian or Murano glass is now ornamented with tracery cut with diamond points. Lanfranco of Modena uses infernal machines, bombs that explode on opening the box holding them; many persons are killed with these in the family fights of the Fontana and Bellincini.

1563. **England**—Mathews improves home-made cutlery, and raises it to excellence. Wire-drawing in mills is introduced at Richmond by Germans. Cambric is introduced by Netherlands.

1563. **Germany**—Alum works are constructed at Glatz, in Austria. *See* 1554.

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1563. **Italy**—The earliest Italian melodrama, 'Aretusa,' is produced, written by Alberto Lollio, Florentine, 1508 to 1566; portions of it are sung, also some chorus parts. Such is the record; but in 1480 'Orfeo,' a lyric drama, had been produced at Rome; probably there were others too. *See* 1554.

1564. **England**—Knitted worsted stockings are re-introduced in England from Mantua, and replace cloth hose.

1565. **England**—Needles are now made locally; they had hitherto been imported from Germany and from Spain. Hawkins first brings some specimens of potatoes from America. Some Flemings begin the manufacture of bombazine at Norwich.

1565. **Germany**—English pencils of graphite, sheathed in wood, are now introduced, and replace the old pencil of lead.

1565. **Italy**—The earliest concerts of the Filarmonichi at Vicenza now take place.

1566. **England**—The charge and control of all coast beacons is assigned by Royal decree to the Trinity House Corporation; hitherto they had some partial control of them, but most were private property.

1566. **France**—Timber is now imported in rafts, as the scarcity of fuel had been pressing since 1549. Robert Constantin publishes a Latin poem of the 6th century on measures in which the hydrometer is described.

1566. **Spain**—Discovery of the Peruvian mines of mercury at Huancavelica.

1567. **England**—Improvements in bell founding and tuning of bells. Stedman introduces change-ringing. *See* 1562. Harbour enlargements and improvement are effected with public lottery funds. Flower-gardening is revived at Norwich by immigrant Flemings.

1567. **Spain**—The firearms used by Spanish troops under the Duke of Alba in the Netherlands are termed muskets, but differ from the older hand-guns. *See* 1525.

1568. **England**—Baize manufacture is begun at Colchester by immigrant Hollanders.

1568. **Italy**—The Breviary is re-arranged and altered by Pope Pius V.

1570. **England**—Sir Francis Drake uses an astronomical ring for nautical observations. *See* 1534. Reputed date of the invention of gauging by hydrometer. *See* 1566. Various new linen cloths are made at Norwich by Flemings and Hollanders. Serge is now made at Stamford by Flemish tuckers.

1571. **England**—Thomas Digges first mentions the theodolite in his 'Pantometria.' Taffeta is now made in London.

1573. **France**—The Spanish musket is now adopted for the French army. *See* 1567.

1575. **England**—A fire-engine exists at Dunstable; it is a single-action pump, worked by levers at both ends moving a plunger. At this time large hand-squirts were used to quench

Record of Progress

fires in London and in most towns of Europe, though the Romans and even the Chinese had used powerful fire-engines.

1575. **Germany**—A saw-mill with several blades is used near Ratisbon, on the Danube.

1576. **England**—Robert Normand, of Wapping, makes observations of the dip of the magnetic needle.

1577. **England**—The use of the log-line is now known; but perhaps long before this.

1577. **Germany**—The Diet forbids, under severe penalty, the use of the newly-invented, deceitful, pernicious, and corrosive devil's dye (indigo) instead of woad. The objection, that vitriol was used with it and might harm stuffs, was evidently only one of the reasons; some vested interests were affected.

1579. **England**—Linen-staining is now practised.

1579. **Holland**—Carpet-dyeing, a Persian art, is now done locally—Hackluyt.

1580. **Spain**—The cultivation of tobacco, and of the sugar-cane, now spreads in Cuba, after the entire subjection of the aborigines.

1581. **England**—Legislation about dyeing blues and blacks; even before this time informers had been ordered to seize and burn all indigo and logwood. The adulteration of honey and of wax is now forbidden. Sedan chairs are now introduced, and afterwards are commonly used.

1581. **France**—Copper coins are now introduced.

1582. **Europe**—New style of dating adopted on 5 October, 1582, in Spain, Portugal, France, Flanders, parts of Holland, of Germany, and of Italy. The ecclesiastical Easter is now the first Sunday after the full moon following the 21st day of March, instead of that following the moon of 14th March. The ancient Saxon Eostre was a feast in honour of Eostre, about 1st of April, and corresponded to the Indian Huli, or spring rejoicings.

1582. **England**—Morris introduces a private house supply of water in London, and uses leaden pipes. *See* 1538. Extensive cultivation of saffron at Saffron Walden; introduced from the Levant in 1339, and grown in England for a long time.

1582. **France**—Amboise Paré proposes the needle and ligature as a substitute for cauterising in cases of amputation.

1584. **Italy**—Federico Gianibelli uses some explosive contrivances, perhaps fougasses, at the siege of Antwerp. *See* 1562.

1585. **England**—Unsuccessful attempt to introduce new style of dating; it seems to have been set aside merely on account of its being a Papal proposal. *See* 1582. Coaches, introduced from Germany in 1580, are used by the Earl of Arundel.

1585. **France**—A royal factory for making firearms is instituted at S. Etienne.

1586. **Europe**—New style of dating adopted in Poland; afterwards, in 1588, in Hungary.

1586. **England**—Tobacco and potatoes are introduced by Sir Walter Raleigh. *See* 1565.

Record of Progress

1586. **Netherlands**—Charles Lecluse of Arias obtains some potatoes from Gerard, botanist, of London, who had grown them from others brought from Peru by Drake (?) in 1586. This introduction of the potato afterwards spreads to Holland and to Italy.

1586. **Germany**—The first ribbon-loom is set up at Danzig; the inventor is killed.

1588. **England**—A new local paper-mill is built at Dartford, in Kent. Lord Burleigh publishes the 'English Mercury' as a newspaper. *See* 1536. Timothy Bright issues a book on shorthand. Flint-locks are known. Fire-ships are used against the Spaniards in Calais roads. *See* 1498. Duelling with small swords comes again in vogue.

1588. **Germany**—Andre Libau of Halle writes on transfusion of blood; he also invents as caustic hyperoxygenated nitrate of tin. Edict of Duke Julius of Brunswick about the effeminate habit of riding in coaches instead of on horseback.

1588. **Netherlands**—Bombshells are made at Venloo, and are used at the siege of Wachtendouk. *See* 1562 and 1584.

1589. **England**—William Lec invents the stocking-loom; its use spread to France, Spain, and Venice. Mexican cochineal is introduced as a dye. *See* 1518.

1590. **England**—Gilbert, at Colchester, asserts the theory of general terrestrial attraction. Davis adopts the Backstaff for solar observations at sea; perhaps some improved primstaff or runestock, things used by Anglo-Saxons and Danes; or perhaps like the Jacob's staff or astrolabe of the Portuguese Jews. *See* 1490. Algebra is now studied, and algebraic letters are used. (Italian introduction of 13th century, Bonacci of Pisa. *See* also 1505.) The iron-slitting mill is now introduced. Pocket watches, having catgut instead of a main chain, are commonly used, their cases being ornamental and costly. *See* 1490.

1590. **Germany**—Reputed invention of the telescope by Jansen, a spectacle maker. Fracastoro used one long before 1553.

1590. **Italy**—Julius Cæsar at Rimini makes observations on the magnetism of iron.

1591. **Netherlands**—Tea is first brought to the Netherlands from the Asiatic settlements.

1591. **Spain**—A three-decked ship-of-war is used in action off the Azores against the English ships of Sir Richard Grenville.

1593. **Corea**—The Coreans invent explosive bombs and use them in repelling a Japanese invasion; but such things had already been used in Europe. *See* 1562, 1584, 1588.

1594. **England**—An engine for conveying water is used at Broken Wharf, London. Publication of Morley's first book of madrigals; the madrigal was originally Flemish, but was English at full development; at this time the English were a singing people, and even sang gracc at meals.

1594. **France**—Erard Boisleduc writes a work on fortification and flank-fire. *See* 1523.

Record of Progress

1595. **England**—The rifling of firearms is known to Plat. *See* 1498. Maunsell writes the first catalogue of printed books. Sir Walter Raleigh introduces mahogany from Guiana.

1595. **France**—Olivier de Serres (1539 to 1619) now introduces silk-weaving and worm-culture in France. He planted 15 000 white mulberry-trees in the Tuileries, and wrote on field crops and fruit-trees; he was the first French agronomist. *See* 1551.

1595. **Italy**—English pencils of graphite are now used instead of the stile of fused lead and tin. *See* 1565.

1596. **Holland**—Cornelis Cornelissen erects a saw-mill at Saardam. *See* 1530, 1547, 1555. Discovery of the whale fisheries of Spitzbergen; this industry is afterwards chiefly worked by Hull merchants and fishermen; the old industry was Norwegian and Biscayan. *See* 1506, 1521, 1388. Record of a fight with a polar bear on an island near the Strait of Waygata, during the voyage of Barentz and Heemskirke.

1598. **England**—Some merchants of Hull invest in undertaking a whale fishery at Spitzbergen. Alum works are commenced at Guisbrough, in Yorkshire.

1598. **France**—The use of indigo for dyeing is forbidden in Languedoc at the urgent request of the people of the province. *See* 1577, 1581.

1598. **Spain**—A prospective reward of 1000 crowns is offered for a mode of determining longitude.

1598. **Netherlands**—A prospective reward of 10 000 florins is offered by the States-general of the Netherlands for a mode of determining longitude.

1598. **Italy**—Potatoes, taratufli, are introduced, perhaps from Spain. *See* 1586.

1599. **Denmark**—The star catalogues of Tycho Brahe of Knudstorp are generally known or available by this time; perhaps even ten years earlier.

1599. **England**—Sailcloth is now largely made in England. Brick buildings become more common; this is ascribed to the efforts of the Earl of Arundel.

1599. **Spain**—The earliest comedies of Lope de Vega are now popular. *See* 1495, 1540, and 1552.

1599. **Italy**—Fulvio Orsini (b. Rome 1529, d. 1599 or 1600) leaves a very large museum of antiquities; perhaps the first in Italy.

DISCOVERY IN SPECIAL BRANCHES.

Archæolo Discoveries.

1503. The statue Apollo di Belvedere is found at Porto d'Anzo (Antium).

1506. The statue Laocoon of Agesander is found in the thermæ of Titus, at Rome.

1508. The Theodosian Table, an ancient map of the Roman Empire made in the time of Theodosius I. or II., is found at Speyer by Konrad Peutinger; it is published by Mureto in 1598.

1549. The Caroline books of Alcuin are published in France.

1566. A Latin poem of the sixth century, in which the hydrometer is described, is published in France by Constantin.

Naturalistic Note.

1517. Girolamo Fracastoro, a noble of Verona, astronomer, physi-

cian, and naturalist, makes the first collection of fossils; probably shells from the Italian hills.

1596. Early mention of a polar bear by the Netherlands with Barentz.

Chemical Separations, &c.

1510. Muriatic acid (*aqua regia*), discovered by Le Comte.

1529. Bismuth, mentioned by Bombast (Paracelsus), is described by George Landmann.

1550. Calamine, a zinc ore known to Paracelsus, is perhaps the ore reduced by Landmann.

1553. Calamine is also reduced by Ebener.

1560-69. Some discoveries about the chemical composition of glass are introduced at Florence by Antonio Neri, who travelled much.

EXPLORATION AND SETTLEMENT.

Africa.

North Africa.

1520. Visit of Alvarez to Abyssinia, where he finds some female soldiers.

1563 c. Travels of Leonard Thurneisser (chemist, botanist, and metallurgist) in Egypt, Ethiopia; also in Arabia and Syria.

1577. An English embassy and a mercantile expedition go to Morocco.

1597. An English envoy is sent to Abyssinia.

Socotra.

1504. Visited by Pereira.

1507. Occupied, perhaps settled, by Albuquerque.

Canary Islands.

1526. First trade with Bristol.

S. Helena.

1502. Discovery by Juan de Nova Castilla.

Gold Coast.

1530. First English expedition to the Gold Coast.

1562. Second English expedition.

1591. Third English expedition.

Benin.

1553. First English expedition to Benin.

1588. Second English expedition.

Angola.

1500. Portuguese settlement first made about.

1508. Lake Ngami is discovered by the Portuguese.

1578. Loanda is built by the Portuguese.

Mozambique.

1506. Discovered by the Portuguese in the 15th century; Albuquerque takes the chief town.

Cerne, or Mauritius.

1505. Portuguese first discovery.

1598. The Netherlands seize the island.

Mascaregne, or Bourbon.

1542. Discovery and naming by the Portuguese.

Madagascar.

1506. First visit of Coutinho, Portuguese.

1548. First Portuguese settlement.

Zanzibar Coast.

1502. Kilwa, or Quiloa, is attacked by De Gama.

1503. Albuquerque discovers the Island of Zanzibar.

1505. Almeida takes Kilwa.

1505. Almeida takes Mombaz.

1528. The Portuguese again take Mombaz, and form a settlement.

1569. Portuguese expedition to the gold mines of Manica, near Zimbao.

Exploration and Settlement

Asia.

Siberia.

1579. Discovery by Yermak Timofeyew.

1587. Russian conquest of the ancient colony of the Mughals, Tobolskoi, ruled by descendants of Shaiban Khan. Russian settlement.

Turkestan.

1558. Jenkinson explores the Caspian Sea and reaches Bukhara.

Persia.

1585 c. Embassy of Filippo Pigafetta from Sixtus V. to the Persian Court.

North India.

1518. The Portuguese first visit Bengal.

South India.

1500. Portuguese bombardment of Kalikotta.

1503. Permanent Portuguese settlement at Kochi.

1505. A Portuguese fleet of thirteen ships is seen at Kalikotta.

1507. Battle at Chewal, after the arrival of twelve Portuguese ships.

1510. Fifteen war-ships arrive to attack Gova; Portuguese occupation of Gova.

1512. Moslem rule is first established throughout Southern India.

1523. Bahádur, king of Gujrat, seizes a ship of the Portuguese.

1533. The Portuguese attack Dru.

1537. Conference at Diu, at which the Portuguese revenge themselves by murder.

1545-48. Severe defeat of Mahmúd III., king of Gujrat, after three years' siege of Dru.

1572. The kingdom of Gujrat is annexed by Akbar Shah.

1589. First Indian expedition of the English Levant Company.

1599. First Charter of the English East India Company.

Ceylon.

1506. Lorenzo de Almeida is driven to Galle by a storm.

1517. Portuguese settlement at Kalambu.

1589. Ralph Fitch visits Kalambu.

1597. The Emperor of Ceylon bequeaths the whole island to the Portuguese.

Malacca.

1511. First Portuguese settlement, after taking Malacca by Albuquerque.

Thai, or Siam.

1511. First visit of Portuguese.

Camboja.

1590. The king asks for Spanish help in a war against Thai.

China.

1517. Andrade arrives at the Island of Timang.

1521. Bad treatment of Pires, Portuguese envoy.

1537. A trading station is formed at Macao.

1556. Romish mission of Bernardo.

1596. The English fleet, with an embassy, is wrecked.

Nippon, or Japan.

1542. De Mota and Mendez Pinto are driven to Nippon by a storm.

1556. Second visit of Mendez Pinto as missionary.

1585. An embassy to the Pope is sent from Japan.

1587. The persecution of Christians begins.

1592 and 1593. Japanese invasion of Korea.

Sunda Islands, Etc.

Sumatra,

1509. First arrival of Portuguese in Sumatra.

Exploration and Settlement

1513. Jean Parmentier visits Sumatra.

1576. Portuguese ships are destroyed at Acheen.

1582. A Portuguese attack on Acheen is repelled.

Java.

1211. First Portuguese settlement.

1596. First settlement of Netherlanders.

Amboyna Islands.

1511. Discovered by the Portuguese.

1521. Portuguese settlement.

Moluccas.

1511. Portuguese discovery.

1519. Occupation by Magellano and the Spaniards.

1519. Visit of the English under Drake.

1521. Second Portuguese settlement.

1596. First settlement of Netherlanders.

Celebes.

1512. First arrival of Portuguese.

Brune, or Borneo.

1518. Discovery by Lorenzo de Gomez.

1521. Visit of Magellano and Pigafetta.

1598. Visit of Oliver van Noort.

Banda Islands.

1511. Portuguese discovery.

Philippine Islands.

1521. Discovery by Magellano for Spain.

1564. Spaniards from Mejique settle at Zebu.

1570. The town of Manila, in Luzon, is taken.

1590. The Sulu pirates defeat the Spaniards.

Ladrones Islands.

1520. Discovery by Magellano for Spain.

Pelew Islands.

1545. Discovery by the Spaniards.

Australasia and Pacific Ocean.

Voyages in the Pacific.

1513. Vasco Nunez de Balboa first arrives on the border of the Pacific Ocean; also called the South Sea.

1519-22. Spanish expedition under Fernando Magellano, after visiting Patagonia in 1519, went to Pitcairn Island, Carteret Island, Dog Island, to Zebu in the Filipinas Island, when Magellano was killed in 1521; the ship returned to Spain in 1522.

1528-29. First discovery of many Islands of Pacific by Saavedra and the Spaniards.

1537. Spanish expedition from Peru across the Pacific Ocean.

Papua.

1511. First Portuguese discovery of Papua.

1543. Villabos gives the name New Guinea to Papua.

Hawaii Islands.

1542. Discovered by Gaetano.

Solomon Islands.

1567-68. Discovered by Alvaro De Mendana de Neyra.

Mendana Islands.

1595-96. Discovered by De Mendana and Quiros.

North America.

Voyages.

1500. Gaspar Cortereal discovers the Gulf of S. Lawrence.

1512. Expedition of Ponce de Leon from Puerto Rico to the Lucayos and Bahamas, whence he discovered Florida.

Exploration and Settlement

1517. Hernandez de Cordova discovers Mejique.

1518. Expedition of Grijalva to Cozumel I., C. Cotoche and Campichi Bay, to Potonchan and to Rio Tabasco; thence to R. de las Banderas and I. S. Juan d'Ulloa (Culua); thence to the Rio Panuco and the Rio Tonalá, and back to Santiago de Cuba.

1519-20. Expedition of Cortés from Cuba to I. Cozumel and to the Rio Tabasco; thence to I. S. Juan d'Ulloa and to Vera Cruz. From Vera Cruz to Tempoalla, in Tlascala; thence to Cholula, which is burned, and to Mejique. Retreat to Tempoalla.

1521-24. Second attack on Mejique is repelled; on the third occasion Cortés takes the town. The provinces, including Honduras, are subdued in three years.

1524. French expedition, under Verrazano, from Dieppe to the American coast, in lat. 30° ; thence coasting to lat. 34° and to lat. $41^{\circ} 40'$, onward to lat. 50° , and return to Dieppe.

1532-36. Expeditions sent by Cortés to California and Colorado.

1534. First Expedition of Jacques Cartier to Newfoundland, where he is wrecked, and to the Bay of Chaleurs.

1535-36. Second expedition of Cartier to Newfoundland, Naticotek I., to the Saguenay R.; up the Hochelaga R. (S. Lawrence) to Stadakonah (S. Charles) and Lake S. Peter; thence to the town Hochelaga, near Mount Royal; and return from S. Croix harbour to S. Malo.

1540-1541. First French attempt to found a town at Kebec, by De Roberval and Cartier; a little blockhouse called Fort Charlebourg is built, but it was soon abandoned.

1549. The expedition of Roberval to Canada is lost.

Arctic Expeditions.

1517. Second voyage of Gaboto and sons.

1527. Voyage of the *Sampson*.

1553. Willoughby discovers Spitzbergen and Nova Zemlya.

1576. Frobisher's voyage.

1580. Jackman's voyage.

1585-88. Three voyages of Davis.

1594-96. Three voyages of Barentz.

Labrador.

1500. Gaspar Cortereal first lands in Labrador.

1512. Gian Gaboto discovers Hudson's Bay.

1576. Expedition of Martin Frobisher.

1585. Davis's expedition.

Newfoundland.

1497. Re-discovered by Gaboto.

1500. Visit of Cortereal and the Portuguese.

1538. English settlement under Hore.

Acadia and Cape Breton Island.

1497. Re-discovered by Gaboto.

1524. Visit of the French, under Verrazano.

1574. Visit of Juan Cortereal.

1576. Expedition of Frobisher. (Apparently no French settlement is made in this century.)

1591. First permanent settlement in Cape Breton Island.

Canada.

1581. French trading vessels go to Canada.

1591. French expedition to Canada.

1598. De la Roche attempts to conquer Canada.

(Apparently no settlement is made in this century.)

Oregon.

1543. Discovery by Bartolomeo Ferrello.

1519. Drake visits Oregon, and

Exploration and Settlement

goes on to New Albion (Vancouver Island).

1585. Exploration of Cavendish, in the North Pacific.

California.

1584. Discovery by Grijalva.

1587. Visit of Cortés.

1589. Ulloa enters the Gulf of California.

1540. Alarcon explores the Colorado.

1542. Exploration of Cabrillo.

New England, or Northern Virginia.

1498. Re-discovered by Gian Gaboto.

(No settlement.)

Virginia and Carolina.

1498. Discovered by Gian Gaboto.

1512. Visit of Juan Ponce de Leon to Carolina.

1564. French settlement in Carolina, and expulsion by the Spaniards.

1584. First English settlement at Roanoke by Raleigh.

1586. Visit of Drake.

1587. Second English settlement in Virginia.

Florida, Georgia, and Alabama.

1512. Visit of Juan Ponce de Leon.

1521. First Spanish settlement, which fails.

1539. Exploration.

1562. Settlement by French Calvinists.

1565. The Spaniards expel the French.

Mejique, or Nueva España.

1517. Discovery by Hernandez de Coidova.

1518. Visited by Grijalva.

1519. Landing of Fernando Cortés.

1521. He takes the town, and conquers the land.

1522. Cortés is first governor of New Spain.

1522. Gil Gonzalez de Avila explores Western Mejique.

1583. Visit of Robert Thomson, who is persecuted.

1571. Establishment of the Holy Office.

Antilles and Carib Islands.

1500. Bobadilla lands in Hayti.

1502. Madania is discovered by Columbus.

1504. Ovando builds the town S. Domingo.

1509. Juan de Esquibal found a settlement in Jaymaca.

1511. Diego Velasquez subdues Cuba with 300 men, and burns alive and tortures his prisoners.

1512. Velasquez forms a settlement in Cuba, after conquest.

1522. Bermudez discovers the Bermuda Islands.

1530 c. The Bahama Islands are depopulated by the Spaniards.

1585. Drake takes S. Domingo, but restores it.

1593. Henry May re-discovers the Bermuda Islands.

1595. Drake is beaten off from Puerto Rico.

1597. Shirley takes part of Jaymaca.

South America.

Voyages.

1500. Diego de Lope explores the coast of Northern Brazil, Guiana, and Venezuela.

1500-01. Juan de la Cosa explores the Rio Siun, the Gulf of Arabia, and the Puerto del Retrete, de los Escribhanos, in the Isthmus of Panama; but the ships are lost in the Gulf of Caragua.

1502. Columbus discovers Portobello and Bay of Honduras.

1502. Guatemala is discovered by the companions of Cortés.

1504-05. Juan de la Cosa again visits the Gulf of Arabia.

Exploration and Settlement

1508. Ponce de Leon subdues I. S. Juan de Puerto Rico.

1509. Juan Diaz de Solis and Vicente Pinzon discover Yucatan province.

1509. Expedition of Hojeda and Nicuesa to form colonies on the mainland. The former governed from C. la Vela to the G. of Darien, the latter from G. of Darien to C. Graciassa Dios. Both were defeated and driven away, but a few colonists under Balboa settle at Sa. Maria el Antigua on the G. of Darien.

1510. Ojeda builds S. Sebastian, Darien.

1511. Expedition of De Solis and Pinzon from the Equator to S. lat. 40° along the coast.

1517. Hernandez de Cordova discovers Campichi.

1523. Guatemala is conquered by the Spaniards, and annexed to New Spain.

1528. Expedition of Sebastian Cabot for Charles V. (intended for the Moluccas), from Spain to the Rio de la Plata, or Argent R. He ascends it and builds Fort S. Salvador, at I. Francis Gabriel, another fort at the confluence of the Caracama and Terceiro. He ascends the R. Paraguay to Potosi, but from want of men cannot conquer Peru. He leaves 120 men at Fort S. Spirito, and returns to Spain.

1531 e. Alvarado attacks Quito from Guatemala.

New Granada.

1509. First nominal Spanish settlement was in Darien.

1513. Voyage of De Balboa from S. Maria el Antigua across the isthmus to G. S. Miguel, on the Pacific Ocean.

1523. Spanish settlement of Cumana and Coro.

1527. Second Spanish settlement of the same.

1537-38. Expedition of Quesada

in Nueva Granada to the plain of Cundinamarca, thence to the sacred city, Sogomushi, of the Muylchas, where his company of 160 men sacked the temple of Nhemquetiba; thence to Bogota, where he founded the town S. Fe in 1538.

1595. Raleigh's first visit to New Granada and Guiana. He destroys S. Joseph in Trinidad, enters the Orinoco, and burns the town Cumana.

1597. Second expedition of Raleigh to attack Spanish galleons; it fails.

Guiana.

1500. Visit of Vincente Pinzon.

1535. Diego de Ordas founds S. Thomas.

1580. Settlement of Netherlanders at New Zealand, Berbice, Demerara, and Essequibo.

Brazil.

1500. Pinzon discovers the River Marañon; Cabral takes possession for Portugal.

1530. Visit of the English, under Hawkins.

1531. De Souza discovers the Bay of Rio.

1540. Orellana discovers the valley of the Marañon, and sails down it.

1549. De Souza founds S. Salvador, Bahia; entry of Jesuits into Brazil.

1555. Some French Calvinists settle at Rio.

1558. Massacre and expulsion of the French.

1567. The Portuguese found the town Rio de Janeiro.

1572. An English settlement fails entirely.

1590. Brazil becomes a Spanish province.

Peru, or Biru.

1522. Exploration of Pascua de Andagoya.

1524. First expedition of Pizarro from Panama.



Exploration and Settlement

1529 to 1531-32. Pizarro acquires Peru by treachery; he seizes the Inca, and founds S. Miguel.

1535-36. Lima and Arequipa are founded.

1537-46. Civil war among the Spaniards.

1546. The Spanish conquest is completed.

1571. The Holy Office is introduced.

La Plata (a Peruvian Province).

1515. Discovery by Juan Diaz de Solis.

1536. Expedition of Sebastian Cabot.

1535. De Mendoza founds Buenos Ayres.

1539. Buenos Ayres is abandoned.

1542-46. Expeditions of Domingo de Yrala in the interior.

1553. New Spanish settlements.

1553. Encroachment of Portuguese from Brazil.

1580. Permanent settlement at Buenos Ayres.

Paraguay and Misiones.

1535. The Spaniards found the town Asuncion.

1536. First settlements of Jesuits.

Uruguay.

1553 c. A portion of the Spanish province of La Plata detached and divided from it by a Portuguese extension of Brazil.

Chile.

1534-36. Exploring expedition of Almagro from Peru.

1540-47. Expedition of Pedro de Valdivia from Peru.

1541. Santiago de Chile is founded.

1541. The first war of independence of the Araucanians begins; these wars last for centuries.

Patagonia.

1519. Discovery by Magellano.

1567. Hawkins visits the Falkland Islands.

1578. Expedition of Drake to Cape Horn.

1594. Second visit of Hawkins to the Falkland Islands.

Antarctic Expeditions.

1576. Juan Fernandez sails from Chile, and reports land to the extreme south.

1599. Dirk Cheritts, in a ship from Rotterdam, arrives at the islands now named the South Shetland Islands.

SEVENTEENTH CENTURY

1600 TO 1699.

PERIOD OF FRENCH GRANDEUR.

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SEVENTEENTH CENTURY

1600 TO 1699.

PERIOD OF FRENCH GRANDEUR

GENERAL DEVELOPMENT.

THE geographical discoveries of this century have not the same importance, in direct bearing on development and on introductions into Europe, as those of last century; they continued in detail, but consisted more in a series of small discoveries than in great ones. The colonial settlements of Europeans in America and Asia were the distinctive feature of this century, and the industries there created by Europeans had their results in commerce of a new sort, and on a large scale with Europe. The various introductions of the past century, as that of sugar, cacao, tobacco, &c., became permanent cultivations, supplying the commerce and the wants of Europe from plantations abroad; while many foreign manufactures, as of Chinese porcelain, Indian muslin, calico, &c., became localised. There were still large private companies for exploration, and the trade accompanying such openings; but there were also colonising companies, whose prospective profits were to come from the land and the plantations formed. Such developments were much checked by wars and encroachments and disputes among the colonising and commercial nations, as well as by opposition of the various indigenous races.

The financial arrangements on which matters were based were still very bad; companies started undertakings with some money, left them unsupported, and required immediate returns at all hazard. Lotteries were the mode of raising money, but these were suppressed. Banks did not yet help by steady financial support, even on a small scale; they were mere places

of deposit, safer than the often abused confidence in a goldsmith, and free from risk of seizure by the government of the King when taxes failed. The funding system was still in its infancy in most countries, in spite of its ancient invention by the Venetians. The taxes of European countries were insufficient for the expense of protecting its colonies—even their mere seaboard were assailable; and petty wars were carried on at private expense, sometimes by private subscription among three or four leading men. Hence, also, public works were still ill-supported, and took no remarkable development under the conditions.

Astronomical knowledge was much extended—in fact the main bulk of it was obtained in this century, chiefly, and in the first place, from more powerful improved telescopes; the great discoveries were partly achieved by private persons, and the public observatories of Europe were still few and ill-supported. The practical results were not confined to better and safer navigation. The astronomical investigations led to a higher knowledge of mechanical motion and of mechanics; they led to the need of improved instruments, of better mechanism; also to trigonometrical surveys of countries. The theoretical results correspondingly were enormous in each of the analogous branches of science, if we compare the deductions of Descartes and of Newton with anything before.

The astronomers of this century were:—John Bayer, of Augsburg, fl. 1627, d. 1660, who introduced star charts; John Banbridge, b. Ashby, 1582 to 1643; Otto Guericke, b. Magdeburg, 1602 to 1686, who discovered the periodicity of comets; Gian D. Cassini, b. Nizza, 1625 to 1712, who made improved solar tables, tables of refraction and ephemerides of the Jovian satellites; Castelli, of Brescia, 1577 to 1644; John Flamsteed, b. Derby, 1646 to 1719, fl. 1674, who made a catalogue of 2884 fixed stars, a celestial atlas, and wrote the 'Celestial History'; Galileo Galilei, b. Pisa, 1564 to 1642, who made tables for determining longitude through the motion of the Jovian satellites; Pierre Gassendi, b. Chantorsier, 1592 to 1655; Johann Hevel, b. Danzig, 1611 to 1687, who discovered variable stars; Edmund Halley, b. London, 1656 to 1742, fl. 1680, who made lunar tables, determined the precession of the Equinox, and predicted the period of the return of the comet of 1682; Jeremiah Horrox, b. Toxteth, 1609 c. to 1640, who first observed a transit of Venus; Christian Huyghens, b. The Hague, 1629 to 1695, who discovered the satellites of Saturn;

Johann Kepler, b. Wiel, 1571 to 1630, who used logarithms in completing Brahe's tables, observed Mars very fully, and wrote on the formation of planets from condensed ethereal matter; Philippe de la Hyre, b. Paris, 1640 to 1718, who wrote astronomical tables; Christian Longomontanus, b. Laensberg, 1562 to 1647, tabulist; Isaac Newton, b. Woolsthorpe, 1642 to 1727, who proposed a planetary theory; Jean Picard, b. La-fèche, 1620 to 1682; Robert Hooke, b. I. of Wight, 1635 to 1702; Olav Roemer, b. Koppenhagen, 1644 to 1710, who proved the law of velocity of light in 1675, and studied stellar parallax; Laurence Rooke, b. Kent, 1623 to 1662, who wrote on eclipses; and Christopher Wren, b. East Knoyl, 1632 to 1723, who made an orrery, and improved astronomical instruments. This list is long compared with that of former centuries, but does not include the observers that merely made improved instruments and telescopes, whereby the astronomic progress was so much advanced.

Geodesy, first started by De Launay, became a new science under Snell in 1617, in Holland.

Botanical knowledge was fostered by a greater number of physic gardens and public gardens than before; but the medicines of the age were less herbal and more mineral. The botanical introductions into various European countries of fruit-trees, vegetables, shrubs, and flowering plants, showed no large development; but scientific classification entered on new lines, and made much progress. The new branch, vegetable physiology, was founded by Grew in 1664.

The botanists and naturalists of this century were:—Hermann Boerhaave, b. Vorhoot, 1668 to 1738; Jerome van Bevernieck, b. Tergau, 1614 to 1690; Federico Cesi, b. Rome, 1585 to 1630, who discovered the sexes and fertilisation of plants (also assigned to Alpini), knew the meteorologic and heliotropic plants, and founded a botanic system; Engelbert Kaempfer, b. Lemgo, 1651 to 1714, who travelled much for botanic research; Robert Morison, of Aberdeen; Marcello Malpighi, b. Bologna, 1628 to 1694; John Ray, b. Black Notley, 1627 to 1705, zoologist and botanist; Robert Sibbald, d. 1712, naturalist; Joseph Tournefort, b. Aix, 1656 to 1708, who made botanic research in Europe, the Levant, Armenia, and Georgia; John Vesling, b. Minden, 1598 to 1649, botanist of Egyptian plants; Nicole de Peiresce, b. Provence, 1580 to 1637, who introduced many exotics into France; and Vallisnieri, b. Modena, 1661 to 1730, who learnt much about aquatic plants. There were also other

local botanists, about whose doings it is difficult to discover and define. Botany was in England comparatively neglected, though in the eleventh century the English had been the leaders of Europe in herbalism, or wort-cunning.

Chemistry lagged far behind the other sciences, so much that it is surprising how much it was neglected in this undoubtedly progressive century.

We must not, however, think that there were not some chemists besides Brandt, Glauber, and Künchel, the discoverers. Several of them were also physicists or scientists in other branches; but the more marked chemists were:—Becker, the German reviver of chemistry, fl. 1669, d. 1691; Brandt, of Hamburg, d. 1692; Boerhaave, who lectured at Leyden, 1668 to 1738; Cassius, of Leyden; Johann Rodolf Glauber, b. Karlstadt, 1604 to 1668; possibly Guglielmini, b. Bologna, 1655 to 1710, who was a crystallographer; Friedrich Hoffmann, b. Halle, 1640 to 1742, who wrote about cinnabar, and invented Hoffmann's remedy; William Homberg, b. Batavia, 1652 to 1715, who invented a new mikroscope; Prince Rupert of Bavaria, 1619 to 1682; Van Helmont, d. 1644, the last of the alchemists; Nicole Lemery, b. Rouen, 1645 to 1715, and perhaps Johann Sturm, the physicist, b. 1635; Papin, b. Blois, 1650 to 1710; and possibly De Caus, fl. 1640 to 1660; George Ernest Stahl, b. Auspach, 1660 to 1734, a chemist who proposed the phlogistic theory of combustion. They were markedly Flemings and Germans.

Mathematics took the large strides given to it by the astronomers that have been already indicated; while the mathematics of mechanism took its rise from the labours of the philosophic inventors, who formed collections of small working models, that were the basis of the important mechanical inventions.

Yet the comparative slowness with which valuable mathematical discoveries were taken up and generally utilised is noteworthy. The logarithms of Napier and of Briggs were tardily adopted by astronomers; analytic or algebraic geometry, proposed by Tartaglia, and developed by François Viète, was ignored by Newton, who wrote in the ponderous geometric form of the ancient Greeks; similarly in other things. The mathematicians of this century were:—Amontons, who wrote the laws of friction; Baffin, the navigator, who discovered the observations for longitude; Bainbridge; Baliani of Genoa, who wrote on motion, optics, and mechanics; Almelooven;

James Bernouilli; Boyle; Borelli, of Naples; Buonaventura Cavalieri, of Milan, 1598 to 1647, who first proposed indivisibles and fluxions; René Descartes, 1596 to 1650; Eschignardi, of Rome; John Greaves, b. Hants, 1602 to 1652; James Gregory, b. Aberdeen, 1638 to 1675; John Harriot, d. 1621 (to be distinguished from Thomas Hariot, also a mathematician), who applied algebra to curves, adopted a generic theory, and reformed notation; Christian Huyghens; Godfrey Baron Leibnitz, b. Leipzig, 1646 to 1714, fl. 1672, who proposed fluxions, and wrote a new arithmetic including them, also he wrote on motion; Abraham Demoivre, 1667 to 1754; Isaac Newton, who largely employed the fluxions of Wallis and the gravitation theory of Hooke in his great developments, and wrote on the prismatic decomposition of light; Blaise Pascal, who invented a computing machine, and wrote on hydrostatics; John Pell, b. Southwick, 1610 to 1685, the laborious mathematical tabulist; Willibrod Snell, of Leyden, fl. 1621; Andre Jacquet, b. Antwerp, 1612 to 1660; Pierre Varignon, b. Caen, 1654 to 1722, who wrote, 1688 c., on hydraulics, mechanics, and infinitesimals; Viviani, b. Florence, 1621 to 1703, who wrote on maxima and minima; John Wallis, b. Ashford, 1616 to 1703, who invented infinitesimals and fluxions, and wrote on algebra and mechanics; and Edmund Wingate, from Yorkshire, 1593 to 1656, who developed the useful applications of mathematics to surveying. Besides, there were Galilei, Kepler, Hooke, Mersenne, Roemer, Torricelli, and Renkin Sualem, who were more markedly physicists. Besides these there was Isaac Barrow, b. London, 1630, d. 1677, who taught Newton the principle of the differential triangle, which he had invented, as well doubtless, as other matters in fluxions.

Geology developed among the few, but was little known to the many; the mineralogists had the monopoly of it generally, and made no records; but the book of Athanasius Kircher in 1662 was a great step—it virtually founded the science as a general subject, and was followed by that of Woodward in 1695. Yet it was merely a short outburst.

The improvement of instruments, and the designing of new ones, was a necessary adjunct to scientific development. It is hardly needful to enter into the subject of telescopes of increased power; every so-called astronomical discoverer owed his discoveries to an improved telescope; Galilei, Huyghens, Newton, &c.; similarly also greater accuracy of observation

was due to successive improvements in astronomical instruments and in clocks and chronometers; both of these things were much done in this century; the genius was hence divided, almost frittered away, that is so often imputed to such things.

The mercurial barometer of Torricelli, 1608 to 1649, was much more convenient than the old English water barometer; also the improved barometer of Huyghens. The improved suspension of the compass needle by Barlow, 1600, was also a great step. The thermometer of Drebbel, 1610; the mikroscope of Galilei, 1610; of Torricelli, 1640 c.; the compound mikroscope of Drebbel and Jansen; the quadrant of Gunter, 1618; the theodolite of 1571 of Digges; the polemoscope of Hevel, 1637; the mikrometer of Gascoigne, 1640; of Auzout and Picard, 1666; and that of Kirch, 1677; the clinical thermometer of Santorio, 1629; the Newtonian thermometer of oil; the watch springs, regulators and pendulums of Hooke and Huyghens; the computing machines of Morland, 1670, of Leibnitz, 1686, and of Pascal, 1623 to 1662—all these things were virtually novelties, and certainly inventions of the age that assisted scientists, and were made by them.

Proceeding now to the physicists, the two novelties were the use of steam and the discoveries in magnetism. The former was a development of various sorts, comprised in the following stages from the simple air pump, the heated air pump, the hot air pump, air engine or pneumatic engine, the low pressure steam engine and the high pressure steam engine, to the eventual combination of both. In most cases record fails to inform us sufficiently about the doings of the various physicist or experimental philosophers who shared in the development. It cannot be assumed that they merely did exactly the things recorded of them, nor that the time of the publication of these things was the time of their discovery. The mere successive records are mere coarse insufficient indications of some things done before various times. The active physicists in this branch generally acted quite independently of each other—in other cases they were evident developers; but all order in the matter is hardly worth preserving. They were:—Otto Von Guericke invented an air pump or pneumatic engine, 1654 c. He was born at Magdeburg in 1602, and died at Hamburg in 1684; Robert Boyle, b. Lismore, 1627, d. London, 1691; wrote on the gain and loss of air in calcination, combustion, and oxidation, and much improved the

pneumatic engine of Guericke. Robert Hooke, b. I. of Wight, 1635, d. 1702, improved the pneumatic engine of Boyle in 1658. Finally, Dionysius Papin, b. Blois, 1650 c., d. 1710, raised this matter in his atmospheric engine in the period 1682 to 1695. Now, regarding the steam engine, it is supposed that Giovanni Branca, b. Pesaro, 1571, d. Loreto, 1650 c., used an eolipile to drive a horizontal bladed wheel (like a water wheel), but only when unloaded could motion be maintained. Solomon de Caus, a Frenchman, fl. 1640 to 1660, did something like it, but better. The Marquis of Worcester, who was a martyr to science, and ruined himself and family in the cause of human progress, wrote his 'Century of Inventions' in 1663, in which the first real steam engine invented by him is described. Dionysius Papin, before mentioned, invented a safety valve, and evidently was aiming at the use of high pressure steam between 1682 and 1695, though he seems to have been diverted into modifying the engine of the Marquis of Worcester. Thomas Newcomen, b. Dartmouth, invented a steam engine in 1695; but Savery's engine was used in 1698 for raising water. State encouragement had been given largely to artists by Louis XIV.; but scientists had to toil and suffer unheeded and without reward; such was the folly of the age. Doubtless there was some pretence that the steam engine was a mere toy.

The science of electricity and magnetism was originally based on the use of the magnetic needle alone. After the improved suspension and box for the compass devised by Barlow in 1600, perhaps Fra Paolo, or Pietro Sarpi, called Polano, b. Venice, 1552, d. 1623, was the earliest magnetic observer beyond England; but William Gilbert of Colchester made a series of experiments on magnetic attraction in 1600. Both Boyle and Hooke made magnetic experiments, but those of the former were published in 1675; and the theory of terrestrial magnetism was proposed by Edmund Halley in 1688.

Curative and animal magnetism began with Van Helmont of Brussels, d. 1644, the last of the alchemists, who wrote on the cure of wounds by magnetism; Valentine Greatorex, b. Ireland, 1628, d. after 1666, used curative animal magnetism in his healings by passes and strokings, and thus revived the ancient method mentioned in the Eddas (*Sigrdrifumal* Strophe 4: "*Words and wisdom give to us, noble twain, and healing hands while we live*"). Probably it was obtained from

Iceland, where it still survives, and is called by outsiders a superstition! In 1678 Lorenzini drew and engraved the electric organs of the torpedo, thus letting the world know that animal electricity was not superstition. But the earliest attempt at making an electric machine was made by Otto von Guericke in 1675.

Continuing to the older branches of physics, light, sound, heat, motion, flow, force, resistance, there were: Baliani of Genoa, 1582 to 1666; Amontons; James Bernonilli; Boyle; Borelli of Naples, 1608 to 1679; Castelli of Brescia; Galilei in many branches; John Greaves; James Gregory; Domenico Guglielmini, in 1655 to 1710; Fr. Eschinardi; Christian Huyghens wrote on dioptrics besides many other branches; De la Hyre; Robert Hooke in many branches; Lanaterzi of Brescia, b. 1637, who specially wrote on aerial navigation, and was an aeronaut; Edme Mariotte; Marin Merenne; Isaac Newton; Roemer; Prince Rupert; Joseph Sauveur, who wrote on musical acoustics; Willibrod Snell, who made discoveries in optics; Johann C. Sturm, the first German who introduced a course of experimental philosophy; Torricelli, who wrote on projectiles; Varignon on mechanics and hydraulics; and John Wallis, before mentioned.

Anatomical science in this century entered on new courses; in simple human osteology and myology the bulk had been already done, but all the more refined discoveries in human anatomy had remained to be gradually made. Apart from these there were two new ramifications of anatomy, or three. First, there was the science of pathologic anatomy, founded by Theophilus Bonnet, b. Geneva, 1620 to 1688, author of the 'Sepulchretum,' treating on the traces of disease left after death; it was a new branch, and however absurd the pretences of surgical infallibility about such deductions may be in many cases, it was on the whole a very useful one; after this time most anatomists were pathologic anatomists, though not expressly so mentioned. Next, the use of the mikroscope extended the field of anatomical science in a new direction. Anthony van Loewenheck, b. Delft, 1632 to 1732, was the first mikroskopist and physiologist; John Swammerdam, b. Amsterdam, 1630 to 1680, was also an early mikroskopist, but apparently more in entomology, and less in other matters. Thirdly, the dissection of animals of all sorts, as well as horses, followed the beginning of veterinary science by Ruini, fl. 1598, and Snape; one of the earliest English comparative anatomists

was Edward Tyson, b. 1649, d. 1708 ; thus there was the third new branch. It is extremely difficult to discover what the early anatomists did and did not ; but apparently human physiology did not become an important branch of science till the time of Albert Haller, 1708 to 1777, nor pathologic physiology till Portal, 1742 to 1832, practised on living animals. If so, these two branches were non-existent in the seventeenth century ; unless we deem hospital practice something analogous on the living human being. Without being able to classify the anatomists of this century, the names of some are these :—Aselli, 1581 to 1622 ; Giorgio Baglivi, b. Ragusa, 1669, d. Rome, 1707, an undoubted physiologist of the functions of the living organism ; Bidloo ; Boerhaave ; Francis Glisson, 1597 to — ; William Harvey, 1578 to 1657 ; Lancisi, 1653 to 1720 ; Van Loewenheck, the mikroskopist ; Malpighi, 1628 to 1694 ; Eustacchio Rudio, fl. 1599 to 1611, who taught Harvey in Italy ; Ruysch, 1638 to 1731 ; Stahl, 1660 to 1734 ; Tyson ; Vesling ; and Willis, 1622 to 1676 ; also Meibom, junior, b. Lübeck, 1638 to 1700 ; Jean Pecquet, b. Dieppe, 1610 to 1674 ; and perhaps Vallisnieri, 1661 to 1730, who wrote on generation of worms, insects, &c., and Santorio.

Among the new branches of learning in this century was the study of Oriental languages, which had been neglected for five centuries. Greek had held its literary sway for two centuries, and its ancient literature had been well explored. Arabic, the old language of science, was, however, only one of the Oriental languages thus studied, but Sanskrit, the more ancient language of the land that supplied the bases of all science, religion, and art to the whole world, was unstudied. Unfortunately, in many cases the tendency was neither scientific, literary, nor historically antiquarian. Hebrew, Chaldaic, Syriac, were studied with the object of literary precision in translation of the ancient religious books of the Jews—a strange infatuation on the part of Christians. Chinese was studied properly and naturally by those connected with China in some way, or resident there.

In the earlier stages some philological work in preparing dictionaries and grammars may have been needful before useful translations of hitherto unexplored literature could be made ; but later, when there was less need, the aim seems to have been lost in the means. The writers were men who had never learnt the languages either from natives, or those that had learnt from them, and the philologic vice of the fireside

ecclesiastic was carried from ancient Greek into living Oriental languages. The inevitable result was that the pupils of such a system were so ill-taught as to find themselves misunderstood in the countries where these languages were spoken.

The Orientalists may be divided into useful translators and philologic workers. The following list may be useful for reference :—

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| <p>Antonio Giggio, <i>b.</i> Milan —, <i>d.</i> 1632—transl. and phil.
 Constantin L'Empereur, <i>b.</i> Opyck 1570, <i>d.</i> 1648—phil.
 Thomas Erpen, <i>b.</i> Leyden ? 1584, <i>d.</i> 1624—phil.
 James Golio, <i>b.</i> the Hague 1596, <i>d.</i> 1667—transl. and phil.
 Bryan Walton, <i>b.</i> Cleveland 1600, <i>d.</i> 1661—evang. transl. polyglott.
 Edward Pococke, <i>b.</i> Oxford 1604, <i>d.</i> 1691—transl.
 Jan H. Hottinger, <i>b.</i> Zurich 1620, <i>d.</i> 1661 c.—phil. polyglott.
 Prosper Intorcetta, <i>b.</i> Piazza 1625, <i>d.</i> 1696—transl. Chinese.</p> | <p>Francis Meninski, <i>b.</i> Lorraine 1623, <i>d.</i> 1698—phil. Turkish.
 Bartolomée d'Herbelot, <i>b.</i> Paris 1625, <i>d.</i> —translator of Persian.
 Johann G. Wagenseil, <i>b.</i> Nurnberg 1633, <i>d.</i> 1705—phil.
 Christopher Cellarius, <i>b.</i> Smalkald 1638, <i>d.</i> 1707.
 Sir Dudley North, <i>b.</i> 1641, <i>d.</i> 1691—phil.
 Antoine Galland, <i>b.</i> Rollet 1646, <i>d.</i> 1715—transl.
 F. Petis (Delacroix), <i>b.</i> Paris 1653, <i>d.</i> 1713.
 George H. Michaelis, <i>b.</i> Kettlemburg 1668, <i>d.</i> 1728—phil. Ethiop.</p> |
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Among sciences there were new works on war and tactics, &c., by Montecuculi and by the Earl of Peterborough, the improver of strategy; also on naval tactics, by B. Renan d'Elisagaray.

Education was much like that of the sixteenth century; the collegiate and university system of teaching Latin and Greek continued; and some new colleges and universities were formed on the same principle; but the mathematical developments of the philosophers of this century were not concurrently taught in them, but deferred to the next century. The spirit of education was shown in the issue of a large number of Greek and Latin books 'Ad usum Delphini' by Dacier, 1651 to 1722. The greater number of public libraries, and collegiate and large private libraries, founded in this century indicates that a demand for them existed, and that grown-up persons had discovered the need of some knowledge beyond that acquired from the clergy in their youth. Academies, formerly chiefly Italian, now take a remarkable development in France, though few in other countries; but they are literary and artistic associations generally not scientific, and perhaps more protective than practical. In England there were some few societies of a corresponding sort; but also several societies having some beneficent

objects, besides the speculative companies and the guilds of craftsmen and tradesmen. Perhaps the suppression of the Society of Antiquaries by the King was the check to academies in England, where clubs rose instead of them, and in some cases partly corresponded to them.

Construction and building followed the course taken in the sixteenth century. Relatively fewer new towns were built or commenced; but fortifying the large towns and fortress-building went on as then. De Vauban and Van Coehorn were the fortifiers of the time. In engineering works, canals of navigation were extended, and new large canals made; the introduction of the canal-lock being an important feature. But in England canals were not made, a certain amount of navigation on rivers and streams had long existed, and more was not yet needed. The development of more waterworks, of lighthouses, dockyards, and docks, were the chief feature in England; there were also some drainage works and land-reclamations.

Among buildings, large churches and cathedral churches continue to be built, but the number of new ones is comparatively few, having regard for the increase of population; some are not only large, but magnificent. Among the civil buildings, palaces and townhalls increase both in numbers and in size: there are also new classes of miscellaneous buildings that now have some architectural pretensions, as exchanges, theatres, libraries, banks, custom-houses. City gates still are built on a large scale; even in England, Aldgate, Aldersgate, and Temple Bar belong to this century.

In Mechanical construction, the apparatus and mechanism and plant for carrying on the new series of manufactures in various countries, and specially in England, must necessarily have been new; the looms of many sorts, the brass and iron foundries, and works and factories, had to be made to suit the special objects. Fire engines and engines for raising water were specially English, and the same motive led to the great and useful invention of this century, the steam engine of the Marquis of Worcester, the patriarch of many. Savery was successful in raising water, and the Belgian Renkin Sualem made the machine at Marly to raise water 400 feet. Yet the saw-mill did not come into use in England, late as it arrived; for a feeble government could not protect a saw-mill against angry sawyers. Fire-arms were doubtless made throughout this century much as in the last, as no important improvements in them are

recorded. In shipbuilding there were alterations of style, and perhaps better work, but hardly any fresh inventions. The making of clocks and chronometers became an important craft, instead of being confined to a few individual craftsmen; it was always a branch of work in which the English were pre-eminent. Gardening, on the contrary, was their worst; nor did the English gardener become valuable in modern times till he had learnt his work from the Fleming, about the beginning of this century. The entire loss of the art is supposed to be due to the destruction of all gardens, &c., in the long civil war of the Yorkists and Lancastrians.

In the Fine Arts, Italy was still on the whole the leading nation. It had the following musical composers:—Monteverde, Giugliano, Carissimi, Lulli, Allegri, Agassari, Pistocchi, Perti, Corelli, Scarlatti, Stradella. In other countries there were Eckard, Thiele of Hamburg, and R. Cambert, who wrote opera; and among the English, Hooper, Blow, Child, Purcell, and Aldrich. Operatic local melodrama was performed in France in 1646, in England in 1656. The Italian painters and sculptors were numerous and good, without arriving at the extreme excellence of the past century. Two nations had, however, developed painting for themselves—Spain and the Netherlands—and rose to their best in this century. In Spain it was the time of Murillo, a purely local genius, also of Cano, Herrera, Jaureguy y Aguilar, Martinez, Palomino, Ribera, and Zurbaran. In the Netherlands it was the period of Rubens, Van Dyk, and many good painters. In France and in England schools of painters were forming or springing up; in the former country there were Blanchard, Bourdon, Le Brun, Callot, Casaubon, Jouvenet, Lairesse, Le Sueur, Mignard, Pouget; in the latter, only Anderson, Barlow, Cook, Cooper, Dobson, and a few very similar.

Poetry and the drama developed locally in several countries on the basis of the doings of the past century. France at last had real comedy, natural and local, in the works of Molière.

POLITICAL CONDITION.

The political condition of Europe was, on the whole, less favourable than that of the preceding century. Spain had crushed France in 1596, but restored everything at the death of Felipe II. A fresh war, from 1635 to 1659, ending with the treaty of the Pyrenees, left Spain deposed from her pre-eminence. But the leading power in Europe during the latter half of the century, after the Treaty of Münster in 1648, was France. Germany had defeated and driven back the Ottomans, but had also become ambitious of universal monarchy over Europe, and intolerant at the same time. The two Emperors, Ferdinand II. and Ferdinand III., ruined the Empire in their attempts; not only did the Protestant princes form a permanent party aloof from the Emperor, but a new nation, Brandenburg Prussia and Pommern united in one, rose into semi-independence of him. The power and influence of Great Britain on the Continent was small during this century; the Stuarts were the worst kings possible; the civil wars of the Parliament and the Puritans enabled the Netherlands to maintain a naval warfare (disputing its naval supremacy) that lasted from 1652 to the peace of Breda in 1667. The short war of 1672 to 1674 finally settled the honour of the flag under the Treaty of Westminster. Only in the latter part of the century, after 1691 and the union of the Netherlands under William III., could Great Britain take part in the war of the Grand Alliance, 1686 to 1697, ending with the peace of Ryswick. Sweden rose to prominence during this century; but Pohlen and Russia maintained opposition to each other, the former being the aggressor; while both of them had to meet the Ottoman encroachments. In Italy, Venetia was occupied in opposing the Ottomans; and some of the states opposed the Spaniards in Lombardy.

Religious wars were as marked a feature in this century as in the last. The Protestants of Bohemia, the Palatinate, and of Sweden, carried on the 'Thirty Years' War, from 1618 to 1648; other German Protestant princes after 1626; and those

of Hungary revolted several times. In Pohlen the Socinians were expelled, and the large Jewish population wanted the laws of Moses in 1624, but did not fight. In France the Huguenot wars continued from 1615 to 1629. In England and Scotland, Puritanism and Calvinism, without any plea of religious oppression, burst forth and contributed much to the civil wars of 1642 to 1649, not entirely ended till 1652, and leaving England nearly prostrate till 1661. The Calvinists of the Valtelina were massacred in 1620.

Purely civil war was comparatively little in this century; in Germany a nominee of the Protestants was advanced for the empire, and all matters of succession were subject to the more absorbing principle. In France, the wars of the Frondeurs, directed against the rule of Mazarin, were merged to some extent in the greater war between France and Spain, affecting it from 1650 to 1659. There was also some civil war in Sweden, Pohlen, and Denmark. In Great Britain there were several outbreaks, besides the Parliamentary war of 1642 to 1649, that aimed at reducing the absolute power of the King, and those of the Covenanters and of the Jacobites; but few of them were important.

Sickness and famine were less desolating in this century than before, the repetitions being fewer. In England there was a severe plague throughout the country in 1625, another from November, 1664, to May, 1666, which was worse, but was the last of the true plagues. This great plague affected most of Europe. In Italy there was severe plague at Milan in 1630. A new plague, the cholera, affected Europe in 1668 and 1669.

In influence beyond Europe, Spain suffered but little from the encroachments of the French, the Netherlands, and the English in her American possessions, except the loss of Brazil, which was recovered by the Portuguese. She also formed settlements in California, Arizona, and Texas. The Portuguese losses in Africa also occurred under Spanish rule; similarly those in the islands of the Indian Ocean, and Ceylon; while their abandonment of India was gradual. The permanent acquisitions of the Netherlands were not very numerous or large, their temporary territories being generally encroachments carried out by them during the time Spain and England were powerless at sea, and fully occupied in European or home matters. The temporary acquisitions were the New Netherlands, from 1623 to 1664; a few of the Carib Islands;

Brazil, from 1624 to 1654; in Africa: Angola, I. of Arguim, Cape Coast Castle, and the Gold Coast; while they retained Curaçao, Surinam, the Cape of Good Hope, Ceylon, and their new settlements in the islands of the Indian Ocean. The English were steadily acquiring influence beyond Europe; their new settlements were at the Cape of Good Hope in 1620, and on the Gambia in 1686, in Madagascar in 1644; those in the islands of the Indian Ocean being small trading posts. In India, her small trading settlements were rapidly acquiring Indian commerce, but were otherwise unimportant. In America her colonial settlements were developed, in Newfoundland, Hudson Bay, New England, Virginia and Maryland, and Carolina; also Jaymaca, and some of the Carib Islands, and Berbice.

The French settled in Canada, and explored Ohio and Louisiana, organising a vast territory before the end of the century. Besides, they were continually encroaching on British territories—Newfoundland, Cape Breton Island, and the part of Nova Scotia afterwards called New Brunswick. They obtained Western Hayti, settled Cayenne, and several of the Carib Islands; also settled at St. Louis, Senegal, and Fort Dauphin in Madagascar, also Island of Bourbon, and Puduchari, in Southern India. The Danish and Swedish settlements were few and small.

RECORD OF PROGRESS AND EVENTS

1600 TO 1699.

PERIOD OF FRENCH GRANDEUR.

1600. **Sweden**—Two canal-locks are now first made at Wenersborg by Hollanders, engineers. *See* 1497.

1600. **England**—William Gilbert of Colchester makes experiments on magnetic attraction. William Barlowe makes a special box and suspends the compass. Portuguese wines come in.

1600. **Netherlands**—The Funding system is introduced; a Venetian invention. *See* 1171.

1600. **Germany**—Indigo is introduced through Holland from India as an economic dye; this destroys the old trade in woad, which was indigenous. *See* 1577.

1600. **France**—Dragoons are instituted by Charles de Cossé, Maréchal de Brisac.

1600. **Italy**—The recitative is first employed at Florence by Jacopo Peri in his opera 'Eurydice.' This is the presumed earliest mention of it.

1600. **Europe**—The general disappearance of leprosy from almost every European country is now complete. It was chiefly due to the labors of the mediæval Medical Knights.

1602. **Italy**—Casciaroli discovers the Bologna phosphorescent stone; but an Indian pyroforous stone had been known from ancient times.

1603. **Great Britain**—Suppression of Taro cards by edict. These were of French manufacture, but the entire system and style was of Venetian introduction from Egypt. Apparently they were all picture cards without numerals, and thus differed from the English cards that were originally Danish, and of Danish introduction from the East in early ages.

1604. **Great Britain**—Middleton introduces deep mining and mine drainage in Cardigan.

1604. **Flanders**—Simon Steven of Bruges proposes improved decimal arithmetic.

1604. **Italy**—Ulysses Aldrovandi of Bologna writes a work on entomology as well as on natural history.

1605. **Great Britain**—Re-introduction of horse-races at Newmarket. *See* 1512. Private coaches now come into general use; they were only introduced in 1585.

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1605. **France**—The carrousel, a tournament of a modern sort, is introduced from Italy.

1605. **Italy**—Cavallini of Bologna invents the sowing-drill, which is described in a book by Segui.

1606. **Italy**—Columna extends botanical science at Rome by publishing his 'Ecpbasis.'

1607. **Netherlands**—Adrian Metius invents a telescope at Alkmaar. Fracastoro had used one in 1517.

1608. **Great Britain**—Thomas Coryat introduces table-forks from Italy, where they were already habitually used by the upper classes in many towns. The process of preparing calomel, described by Beguin, is now well known; calomel is used as a universal remedy for everything by medical men. *See* 1512.

1609. **Great Britain**—Some improvements in the use of alum in dyeing are now made. Copper tokens begin to supersede leaden tokens, but are not legalised till 1620. *See* 1581.

1609. **Germany**—Johann Kepler determines the ellipticity of the planetary orbits.

1609. **Italy**—Guido Ubaldo explains the laws of perspective, long known in England. *See* 1279. But they had been known to Lomazzo and Barozzi (Vignola).

1610. **Netherlands**—Cornelius Drebbel of Alkmaar invents the thermometer, and at first uses extract of cochineal.

1610. **Italy**—Galileo Galilei makes and uses an improved telescope, which enables him to discover the satellites of Jupiter. It is supposed that he also invented and used a mikroscope.

1611. **Italy**—Chopines half a yard high are worn by women in Venice; it is supposed that they were of Asiatic, perhaps Chinese, introduction.

1612. **Netherlands**—The cinnamon trade of Ceylon is wrested from the Portuguese, also much of the spice trade; but disputes about it continue till 1663.

1613. **Great Britain**—Improved water supply to towns by bringing water from distant clean sources.

1613. **Netherlands**—Beginning of the consideration of International Law; Hugo de Groot (born at Delft), issues a work 'On the Rights of Peace and War'; also works on religious rights and doctrines.

1613. **Germany**—Martin Weigel of Freiberg employs crown and cone bits; improved rock-drilling in mines, also blasting.

1614. **Great Britain**—Baron Napier of Merchistoun publishes his book on Napierian logarithms. Flint gun-locks are now made locally. *See* 1588.

1614. **Italy**—Antonio Carrer introduces the English stocking-loom in Venice; as an ambassador to England he must have thought it a novelty.

1616. **Great Britain**—The English have by this time learnt improved gardening from the Flemish gardeners of last century, as there is a Gardener's Company of craftsmen. The Fruiterers' Company of 1605 may have consisted merely of fruit-sellers.

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1616. **Italy**—Papal condemnation of the Kopernican theory, and imprisonment of Galileo.

1616. **Europe**—General widespread introduction of potatoes, tobacco, and Mokha coffee. The two former were British introductions, but coffee had been seen in Egypt by Prospero Alpini, the botanist, b. 1553, d. 1617.

1617. **Netherlands**—The compound mikroscope is invented about this time; it is ascribed to Cornelius Drebbel, and to Zacharias Jansen, spectacle maker of Middelburg. *See* 1610.

1618. **Great Britain**—Henry Briggs invents logarithms convenient for ordinary computations. Gunter, a teacher of mathematics, invents a portable quadrant. First British Pharmacopeia is compiled, apparently by a Portuguese. *See* 1542.

1619. **Great Britain**—Dud Dudley succeeds in making coke, pig-iron, after many losses. Supposed discovery by Harvey of the general circulation of the blood; but the greater and smaller circulation was known to Ctesalpinus in 1583. Harvey had studied in Italy under Eustacchio Rudius, who taught medicine and surgery at Padua from 1599 to 1611.

1619. **France**—Death is still the punishment for heresy and atheism. Lucius Vanini is killed at Toulouse for this offence, real or suspected; but about this time greater humanity is shown in such cases in France.

1620. **Great Britain**—Lord Bacon writes his 'Novum Organum,' and proposes that division of labor should be carried out in full detail. Mining powder is made locally. Coining with a die now comes in vogue; milled edges follow in 1630.

1620. **Netherlands**—African slaves are introduced in the New Netherlands, and this principle of slave labor afterwards extends through them to the English plantations of Virginia.

1620. **Spain**—Agronomic science is founded in Spain by Gabriel A. Herrera of Talavera.

1620. **Italy**—Violins are now made at Cremona and other places in numbers. But this is the later Italian period. *See* 1540.

1621. **Netherlands**—Willibrod Snell of Leyden deduces the laws of refraction during his (the first) trigonometrical survey of Holland, begun in 1617. Perhaps the use of Digges' theodolite enables him to do both of these things. *See* 1571.

1621. **Germany**—Lewis Pfannenschmidt, a Thuringian, makes wooden bellows for miners at Ostfeld, near Goslar; his life is protected by the Government.

1622. **Italy**—Asellius of Pavia discovers the lacteals in a dog.

1623. **Norway**—Silver mines are discovered at Konigsberg, in Norway.

1623. **France**—Atheism becomes popular; the estimated number of atheists in Paris is 50 000.

1623. **Italy**—Death of Fra Paolo or Pietro Sarpi, Polano, b. Venice, 1552, the earliest Italian experimenter on magnetism.

1624. **Great Britain**—Coal is now used in iron manufacture. *See* 1619. Also in glass-making.

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1624. **Netherlands**—A stamp-tax is first levied with the aim of reducing litigation ; this mode of raising taxes afterwards spread to Saxony and to England.

1625. **Great Britain**—Yarranton's improved mode of tinning iron plates is now adopted. Public hired coaches are now first used at London, afterwards in other towns.

1626. **Great Britain**—Some Flemings introduce pillow-lace making in Bedfordshire, and in Bucks.

1626. **Italy**—Bon. Cavallieri of Bologna develops modern geometry, and founds the principle of indivisibles.

1627. **Great Britain**—Hacket and Strada patent a process for converting coal into smokeless fuel.

1627. **Germany**—Kepler's astronomical tables are published ; 'Rudolphine Tablets.'

1629. **Netherlands**—The algebraic works of Albert Girard on negative roots, etc., are now published.

1629. **Italy**—Santorio of Padua invents a thermometer. *See* 1610.

1630. **Great Britain**—Rise of the lace manufacture of Honiton (or Hôgniton). Umbrellas, probably large fans or sunshades, are used by men and women.

1630. **France**—François makes painted wall-hangings, perhaps of paper, at Rouen. Toutin improves painting in opaque enamel at Chateaudun. *See* 1513. About this time Tavernier, b. Paris 1605, makes his speculative travels in Turkey, Persia, and India, to deal in precious stones ; he collected much wealth by trading.

1630. **Italy**—A permanent gazette now appears continuously at Venice ; it differs from the temporary gazettes of war news that existed between 1536 and 1570. *See* 1588.

1631. **Great Britain**—Porcelain is now steadily imported from China. *See* also 1518 and 1520. Calico is imported from India, where it had been made from ancient times. The algebraic discoveries of John Harriott, who died in 1621, are now published.

1631. **France**—Gassendi observes a transit of Mercury over the sun's disc, from Paris.

1633. **Great Britain**—Improved fire engines are introduced from the Netherlands ; perhaps the makers of the English fire-engines had died out. *See* 1575.

1634. **Great Britain**—Westling discovers the human lacteals and delineates them. *See* 1622. Joseph Lanyer patents improved wall-hangings of various materials on account of the mode of surface ornamentation ; these develop into paper-hangings. Duncombe, the patentee, introduces sedan chairs into England.

1634. **Netherlands**—Rise of stock-jobbing in tulips, and of artificial exchange quotations. It lasted only until 24 February, 1637.

1634. **France**—Bombs are used at the siege of La Mothe. *See* 1593, 1588, and 1325.

1635. **Great Britain**—Stone cannon-balls are still used occasionally. Raisin-wine is now made locally. Portuguese wines had only been introduced in this century, since 1600.

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1637. **Great Britain**—A three-decker war-ship is launched ; a Spanish invention. *See* 1691, also 1609.

1637. **Germany**—Hevel invents the polemoscope at Danzig.

1637. **France**—Réné Descartes makes his researches in optics ; he develops the algebraic geometry of François Viète, writes a treatise on mechanics, and founds the Cartesian system. Death of De Peiresce, who had introduced many exotic plants, among them Adam's fig.

1638. **Great Britain**—Robert Fludd explains animal magnetism of the human body.

1639. **Great Britain**—Jeremiah Horrox and Crabtree observe the first recorded transit of Venus. Horrox also develops a lunar theory.

1640. **Great Britain**—Gascoigne invents and makes a mikrometer.

1640. **Spain**—Jesuit's bark or Peruvian bark or Chinchona is introduced from South America.

1640. **Italy**—The trompe, or water-bellows, is invented about this time.

1641. **Great Britain**—Rise of the Manchester cotton manufacture ; the cotton comes from Smyrna and Cyprus. *See* 1328. Richard Harris invents pendulum clocks. Sugar cane is now grown in Barbados.

1642. **Great Britain**—Enamelled pottery is now made locally. *See* 1631, 1630, 1518, 1513.

1643. **Great Britain**—A new scarlet dye is used at Bow by Kepler, a Hollander or Fleming ; this Bow-dye may either have been that of Peter Koek, the Flemish painter—*See* 1557—or the Kuffel or Keiffer color from Leyden, discovered accidentally by Drebbel before 1634. Excise duties are first successfully levied.

1643. **Germany**—Ludwig von Siegen makes a mezzotint engraving at Kur Hesse.

1643. **Italy**—Evangelista Torricelli, pupil of Galileo, invents a barometer at Florence ; yet in Somersetshire a coarse water-barometer has been used as a weather-glass from ~~olden~~ ^{old} time, probably long before this, and is used in cottages till now. Torricelli also used fused glass beads as mikrosopes.

1645. **Great Britain**—Rise of private banking with goldsmiths, instead of placing money at the Mint.

1646. **France**—Codeau establishes the cloth factory of Sedan. First performance of a French opera, 'Akbar,' in the bishop's palace, Carpentras.

1647. **France**—The bayonet is now mentioned 'in instructions to the French army.

1648. **Great Britain**—Prince Rupert either invents mezzotint engraving or introduces it. *See* 1643.

1648. **Europe**—The principle of preserving the balance of power in Europe is publicly admitted at the Treaty of Munster.

1649. **Great Britain**—Brass manufacture is recommenced at

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Esher, in Surrey; perhaps on account of some new opportunity of getting the materials in large quantity. The first English frigate, the 'Constant-Warwick,' is built.

1649. Netherlands—Pendulums are applied to clocks by Huyghens; the invention was that of Richard Harris. *See* 1641; but it is also ascribed to Galileo.

1650. Great Britain—Sir Walter Raleigh writes the earliest English work on ships, 'The Invention of Shipping.' Brass manufacture exists on a large scale in Nottinghamshire and in Surrey.

1650. France—Giacomo Torelli introduces theatrical scenes with mechanism in France from Italy; he is termed the Great Sorcerer. It is supposed that movable scenery, &c., was invented by Bernardo Buontalenti of Florence, 1586 to 1608, a military engineer.

1652. Great Britain—Jolyffe, the anatomist, makes some discoveries about the lacteals and lymphatics. Reported date of the introduction of canal-locks. *See* 1497 and 1600. The first coffee-house is established in London.

1653. Sweden—The first saw-mill is erected. *See* 1630, 1547, 1555, 1575, 1322.

1653. France—The first Tontine is opened. The minuet is danced by Louis XIV. at Paris, and by repute had been recently invented in Poitou.

1654. Netherlands—Huyghens improves the telescope, and with it discovers Saturn's ring and a satellite.

1654. Germany—Otto von Guericke invents the air-pump at Magdeburg.

1655. Great Britain—Hobbes publishes his treatise on logic. *See* 1620 and 1553.

1655. France—Isaac de la Peyrière discovers that the world was peopled before the time of the Jewish or Chaldean Adam; he supports his theory from the Christian scriptures by quoting Pauline Epistles.

1656. Great Britain—An English opera is performed at the theatre of Sir W. Davenant. *See* 1646, 1800. Tradescant and Pettiver make collections, termed museums. *See* 1599, 1346.

1656. France—Air-guns are invented either by Rinault or by Marin of Lisieux.

1656. Italy—A Franciscan monk at Pisa discovers carmine and its preparation.

1657. Great Britain—Thomas Garway sells tea in London, perhaps largely. *See* 1591.

1657. Germany—Johann Hautsch invents fire-engines at Nürnberg. *See* 1633, 1575.

1658. Great Britain—Hooke greatly improves the air-pumps of Boyle and of Von Guericke, 1654.

1658. Netherlands—Improved chiming-bells and carillons made by Hemony of Amsterdam. *See* 1562.

1658. France—The works on logic of Pierre Gassendi, the

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mathematician, are published after his death. *See* 1655, 1620, 1558.

1660. **Great Britain**—Cacao, formerly from Mejique, is cultivated in the British Antilles and Islands.

1660. **Italy**—Marcellus Malpighi makes anatomical discoveries about the lungs, liver, and kidneys; also some further discoveries about circulation of the blood.

1661. **Great Britain**—Graunt writes a work on, 'Bills of Mortality,' and introduces statistic science hitherto known only in Italy. *See* 1889.

1662. **Great Britain**—Hooke makes a marine pendulum clock, for telling relative longitude. *See* 1530. James Gregory proposes the astronomical telescope that is used by Newton.

1662. **Germany**—Athanasius Kircher writes his book on ecology, 'Mundus Subterraneus.'

1662. **France**—Death of Blaise Pascal, b. Clermont, 1623, mathematician, inventor of a computing machine, writer on vaulting and hydrostatics, and opponent of the Jesuits.

1663. **Great Britain**—The Marquis of Worcester publishes his 'Century of Inventions,' and makes the first steam-engine. Sir Roger l'Estrange prints a newspaper. *See* 1630. A saw-mill is erected near London, but abandoned on account of opposition. *See* 1653.

1663. **Netherlands**—Huyghens makes a chronometer, combining the spring and the pendulum. Wheeled coaches are forbidden at Amsterdam, from their wearing the pavement.

1663. **Spain**—The sowing drill of Joseph Locatelli, a Carnithian nobleman, is used at Madrid. *See* 1605.

1664. **Great Britain**—Nehemiah Grew founds the science of vegetable physiology and anatomical research.

1664. **France**—Colbert introduces carpet making; hitherto Spanish and Oriental carpets were used. About this time, King Louis XIV. founds an academy for French artists at Rome, at the suggestion of Charles Lebrun, first painter to the court.

1665. **Great Britain**—A diving-bell is used in recovering cannon from a sunken Spanish ship off the Isle of Mull (recorded by Sinclair). James Stuart, Duke of York, proposes an improved code of flag-signalling. *See* 1420. Joseph Glanvil writes on mesmerism, witchcraft, and allied subjects. Earliest establishment of consuls' letters of health. *See* 1527.

1665. **Italy**—Domenico Cassini discovers the period of Jupiter, and finds four satellites of Saturn.

1666. **Great Britain**—Newton uses fluxions—*See* 1626; and makes optical experiments. He applies the principle of gravitation to celestial bodies in detail, which was known generally by Pythagoras, and was due to Hooke. Blotting paper now first appears in bills for writing materials.

1666. **Holland**—Admiral de Witt uses chained shot in naval warfare.

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1666. **France**—Auzout and Picard reinvent the mikrometer.
See 1640.

1667. **Great Britain**—Private insurance offices are instituted in London.

1667. **France**—The grenade is now first used by the French army. The king founds French artistic education, and encourages the fine arts by purchasing the Gobelins' factory—*See* 1557, and making it a Hôtel Royal for painters, artists, weavers, jewellers, etc.
See 1664.

1668. **Great Britain**—Animal respiration, studied by Mayow, is now better understood.

1669. **Great Britain**—Hook makes some improvements in dyeing fast colours.

1670. **Great Britain**—Blasting, perhaps with large charges, is introduced by German miners. *See* 1620. Sir Samuel Morland invents the capstern and makes some calculating machines. *See* 1662. He also uses the speaking-trumpet. John Wallis writes his treatise on mechanical motion. *See* 1637.

1670. **Germany**—Heinrich Schwanhard discovers the art of liquid etching on glass at Nürnberg; probably he uses nitric acid, as fluorspar was generally unknown till 1725.

1670. **France**—Sebastien le P. de Vauban proposes to raise a corps of military engineers for fortresses and military bridge-making.

1670. **Italy**—Francesco Lana-terzi (b. Brescia 1637) now publishes his work 'Prodomo all arte maestra,' describing a hundred new inventions. *See* 1663 and 1550.

1671. **Germany**—Early Sanatory Act, in an order of Berlin, that every countryman coming to market shall take away a load of dirt.

1671. **France**—First public performance of a French opera, 'Pomone,' at Paris. *See* 1646.

1672. **Netherlands**—Vanderheide uses flexible hose with fire-engines.

1672. **Germany**—The bishop of Münster uses the carcass at an attack on Groll. *See* 1667 and 1634.

1672. **France**—The Funding system is introduced by Louvois.
See 1600.

1673. **Great Britain**—Sugar-cane is cultivated in Jaymaca. *See* also 1641. Ignition by phosphorus is now well known, but not commonly practised.

1673. **France**—De Vauban adopts parallels of attack at the siege of Maestricht.

1674. **Great Britain**—Some Venetians make plate-glass at Lambeth for the Duke of Buckingham. Hook invents a camera lucida, which shows the image of an object represented on the wall of a light room.

1674. **Germany**—Rise of conchology; John Major publishes his tables of ostracology at Kiel.

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1675. **Denmark**—Olav Roemer discovers the velocity of light through observations on the satellites of Jupiter.

1675. **Great Britain**—The results of the experimental researches in electricity of Boyle are published.

1676. **Germany**—Otto Guericke of Magdeburg makes an electrical machine about this time.

1676. **Great Britain**—Repeating watches are used. Calico printing with the Dutch loom begins at London (*see* 1681); but is strongly opposed by Spitalfields weavers (Huguenots).

1677. **Great Britain**—King Charles introduces Italian fiddles, called violins, from Italy or France. *See* 1620.

1677. **Germany**—Kirch reinvents the mikrometer. *See* 1640, 1666.

1678. **Great Britain**—Robert Morison of Aberdeen adopts an improved botanic classification.

1678. **Germany**—First public performance of a German opera, 'Adam and Eve,' by Thiele at Hamburg.

1678. **Italy**—The electric organs of the torpedo are drawn and engraved by Lorenzini.

1680. **Great Britain**—Robert Hooke invents and makes a screw-propeller for marine propulsion. Godfrey Hancwitz carries on a phosphorus factory at Southampton Street, Strand; the phosphorus is dear but is much used for ignition.

1680. **France**—The modern parasol is introduced; it has been used in Italy for ages. *See* 1630. It was known to the Romans and Greeks, and was Egyptian and originally Indian.

1680. **Italy**—Setalla and Tchernhausen make improved burning-glasses.

1681. **Great Britain**—A penny post for London letters is instituted by private persons.

1681. **Italy**—Death of the military strategist, Raimondo Montecuculi (b. Modena 1608, d. Linz 1681), who wrote on War, and on the Art of Ruling.

1682. **Great Britain**—Hospitals for invalided soldiers and sailors are now instituted.

1682. **France**—Dionysius Papin begins his experiments on steam, air-engines, &c.; he had been preceded in his own country by Solomon de Caus, 1640 to 1660.

1683. **Great Britain**—Dragoons to serve either on horse or afoot are now introduced; the regiment of Scots Greys is the first. *See* 1600.

1684. **Germany**—Leibnitz publishes his method of fluxions, which corresponds to that of Wallis, but may have been an independent invention.

1685. **Great Britain**—William Blake institutes charity-schools at Highgate. Immigrant Calvinists from France revive carpet-manufacture. *See* 1544. Death of Becher the chemist in England, who proposed the manufacture of coal-tar.

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1685. **Germany**—Clay tamping is adopted in the Hartz mines and in Saxony.

1686. **Germany**—Baron von Leibnitz invents a calculating machine. *See* 1670 and 1662.

1687. **Great Britain**—Newton's 'Principia' are now published.

1688. **Great Britain**—Edmund Halley proposes the theory of terrestrial magnetism.

1688. **Netherlands**—Meuvis Bekker of Amsterdam invents the 'camel' for passing sandbars; but there is no doubt that the ancients used this principle.

1688. **Germany**—Wooden fire-tubes and pasteboard cartridges are adopted at Clausthal. Settlement of exiled French Huguenots at Cassel, where they build the Ober Neustadt.

1689. **Great Britain**—The Funding system is introduced. *See* 1672, 1600, 1171. Death of Thomas Sydenham, b. Dorset 1624, d. London 1689, founder of rational medical treatment; he suited his treatment to the individual, and the conditions, atmospheric, &c.; hitherto a Procrustean system of equal treatment had been classic.

1690. **Great Britain**—The socket bayonet supersedes the plug bayonet, which was placed in the musket barrel. Muslin of home manufacture is now to be had; an Indian invention. Commerce with Russia from Ramsgate begins.

1690. **Germany**—Christopher Denner of Nurnberg invents the clarinet; but it is a very ancient Indian instrument, and this was perhaps a mere introduction.

1691. **France**—The looking-glass factory of S. Gobain is established; such things were well known in England in 1279; and such factories existed in India from remote times.

1691. **Italy**—Guglielmini publishes his work on Hydraulics, originating the science of the movement and flow of water in rivers and canals.

1692. **Russia**—Peter I. sends Everard Isbrantz Ides (b. Gluckstadt in Holstein) on a commercial mission to the emperor of China. Ides visited Siberia and Tartary, and wrote an account of his travels; d. 1700.

1693. **France**—Water-clocks are introduced in Paris; an ancient Indian invention. Bayonets, of some new sort perhaps, are used at the siege of Turin, and in the wars in Belgium. *See* 1647 and 1690.

1694. **Great Britain**—Stamp duties on many things are now introduced. *See* Netherlands. The hackney coaches of London are now about 700 in number. Public banks instituted.

1695. **Great Britain**—John Woodward writes his work on fossils and mineralogy. *See* 1662. Thomas Newcomen, b. Dartmouth, invents a steam-engine.

1695. **France**—Dionysius Papin invents the atmospheric steam-engine, also several improvements in the application of steam.

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Philippe De la Hire, the astronomer, writes a treatise on Mechanics. *See* 1670, 1637.

1696. **Great Britain**—Suppression of the Sanctuaries, refuges from seizure and personal violence. The right of Sanctuary and of Abjuring the realm had been abolished in 1624, excepting for debtors. Letter-covers are now known; probably a Spanish introduction, as they were used in Spain before 1640. Formerly wrappers or napkins were used instead.

1698. **Great Britain**—Captain Langford scientifically investigates hurricanes, storms, &c. Savery's steam-engine is used for raising water. *See* 1643 and 1594.

1698. **France**—A metronome of some sort is now known.

1699. **Netherlands**—About this time many exotic plants, and the knowledge of others, have been introduced by Frederic Ruysch (b. the Hague 1638, d. Amsterdam 1731), the anatomist. His museum is purchased by Peter I. of Russia for 30 000 florins.

1699. **France**—The file-cutting machine of Duverger, perhaps the earliest, now appears.

1699. **Russia**—Some long-disused gold mines are found, and worked again.

DISCOVERY IN SPECIAL BRANCHES.

Archaic Discoveries.

1610. Ancient chronological tables are found in the island Paros [these are eventually bought by Lord Arundel (1580 to 1646)].

1628. The prose Edda of Snorro Sturlason is discovered in Iceland.

1643. Brynjolf Swendson discovers the importance of the Eddaic books, dating 500 to 800 A.D., and finds the vellum Codex of the Eddaic collection of Sæmund Sigfussen (in Denmark).

1669. The Isiac table of Egyptian inscriptions is published at Amsterdam, by L. Pignoria.

Naturalistic Notes.

1634. The Dodo, a non-flying bird of the Mauritius, is described by Sir Thomas Herbert.

1637. The Angora cat is introduced in France by Nicole de Peiresce, the botanist.

1638. Early mention of a sea-serpent near Lynn by John Josselyn (after published in a book of voyages to New England in 1673).

1680. Reputed date of the entire extinction of the wolf in Caledonia; one was killed there this year.

1681. Extinction of the Dodo of the Mauritius.

1686. Frog spawn first introduced in Ireland, in the grounds of Dublin University.

(This absence of frogs accounts

for the absence of some snakes only, as others live on rats.)

1698-1708. The Solitaire, a bird of Mascariégue (Bourbon), is described by François Leguat.

Chemical Separations.

1604-68. Discovery of Glauber salt; of an improved mode of obtaining nitric acid and muriatic acid; the separation of salammoniac from bone by using muriatic acid. The preparation of sulphate of ammonia, of muriate of ammonia; and of sulphate of copper through the action of sulphuric acid on copper rust; all discoveries of Glauber.

1608 c. The preparation of calomel by Béguin.

1656. Carmine is made at Pisa by a monk.

1668. Phosphorus known to Brandt at Hamburg.

1669. Becher proposes the manufacture of coal-tar.

1689. Discoveries in fixing dyes by Hook.

1678. Ignition with phosphorus is well known in England.

1681. Nitric ether re-discovered by Künchel (but it was known to Basil Valentine, c. 1428, and to Lullo, 1266).

1687-1710. Papin extracts gelatine from bone.

1691. A new mode of preparing phosphorus by Homberg.

EXPLORATION AND SETTLEMENT.

North Africa.

1625. Visit of Geronimo Lobo, with Alfonso Meneses, to Abyssinia; the Portuguese missionaries are driven away.

Africa.

Various British-African companies were formed—the first in 1613, the second in 1631, the third in 1663, the fourth in 1672.

Arguin Island.

1638. Occupation by the Netherlands.

1665. The English take the island.

1666. The Netherlands recover it.

Senegal.

1626. The French found St. Louis.

1678. The French take two forts of the Netherlands.

1692. The English take those two forts.

1692. The French build Fort St. Louis.

1693. The French retake the two forts.

1697 c. Explorations of Brue, commandant of Senegal, from Arguin to Bissao; also in the interior, Galam and Bambuk; his account was given by Father Labat.

Gambia.

1619. English explorations.

1621. Later English explorations.

1665. Exploration of Vermuyden.

1686. English settlement.

Gold Coast.

1637. The Portuguese settlements and forts of Elmina, Arguin, &c., are taken by the Netherlands.

Cape Coast Castle.

1610. Portuguese settlement.

1643. The Netherlands take the settlement.

1661. The English take the settlement.

1665. De Ruyter attacks the English.

1667. Cession to England under treaty.

Congo.

Visits of Baltel in 1607; Guttene in 1666; of Sorrento, 1682; of Daffer, 1686; visit of Barbot, 1688.

1667. Visit of Carli de Piacenza to the Congo.

1696. Visit of Zucchelli and Gradisca to the Congo, as missionaries.

Angola.

1640. The Netherlands take Loando.

1648. The Portuguese recover Loando.

1654-68. Visit of Giovanni Cavazzi to Angola, Matamba, and the islands Coanza and Loana; he furthered his missionary efforts by torturing and beating natives that relapsed into idolatry.

Exploration and Settlement

Cape of Good Hope.

1620. English occupation and settlement.

1650. The Netherlanders form a colony.

Zanzibar Coast.

1631. The Portuguese are expelled from Mombaz by the natives.

Mascarégue, or Bourbon.

1642. First French settlement.

Cerne, or Mauritius.

1644. First permanent settlement of Netherlanders.

Madagascar.

1642. The French destroy a Portuguese settlement, perhaps two.

1642. French settlement at Fort Dauphin.

1644. English settlement at St. Augustine Bay.

1672. Reverses of the French, who are defeated and expelled by the natives.

Asia and Indian Ocean, &c.

South India.

1601-07. Captivity of Francois Pyrard of Laval in the Maldives, for seven years.

1612. English factories at Surat, Ahmadabad, and Kambhayat.

1614. Defeat of the Portuguese at Bombay by the English.

1614-26. Travels of Pietro della Valle in Persia and Southern India.

1616. English factories at Kalikota and Masulipatam.

1617. Danish settlement at Tranquebar.

1620. Danish acquisition of Tranquebar.

1626. The English first trade at Palighat on the east coast.

1639. English settlement at Madras.

1641. Fort S. George, Madras, is founded.

1663. English factory established at Karwar.

1664-67. Travels of Jean de Thévenot in Persia and Southern India.

1664. Maratha attack on Surat.

1668. Acquisition of Bombay Island by the E. I. C.

1672. French purchase of land at Pudukhari.

1674. French settlement of Pudukhari. Rise of Maratha power under Sivaji.

1687. Bombay made the chief town of English settlement.

1689. Fort S. David, South Pennar, built.

India.

1600. Charter of the E. I. Company.

1610. Embassy of Hawkins to Jahangir.

1615. Embassy of Sir Thomas Roe to Jahangir.

1631. Shah Jahan expels the Portuguese from Hughli.

1635. The English enter the Ganges, and open commerce.

1650. English factories at Hughli and Balasur.

1686. Factory established at Calcutta.

1690. Aurangzeb seizes three factories of Christians.

(?) Danish settlement at Serampur.

1696. Re-establishment of the Calcutta factory.

Burma.

1600-99. No settlements and no history.

Thai (or Siam) and Anam.

1612. First visit of English.

1684. Commercial treaty with England.

1685 and 1687. Arrival of French missionaries with soldiers, who occupy the Fort of Bangkok.

Exploration and Settlement

Before 1686. Scientific observations of the missionary Gui Tachard and other Jesuits; first expedition.

Before 1689. Second expedition.

1690. Revolt, deposition of the king, and expulsion of the French.

Malacca.

1605. The Netherlands attack Portuguese settlements.

1640. Malacca taken and occupied by Netherlands.

Ceylon.

1602. First landing of Netherlands.

1609. Settlement of Netherlands under treaty.

1612. Fort Cotta built by the Netherlands.

1630. First serious defeat of the Portuguese.

1638. Defeat and massacre of Portuguese.

1658. Entire expulsion of the Portuguese.

1663. The Netherlands open a flourishing commerce, make coast canals, &c.

China.

1600-10. Mission of Matteo Ricci, Roger and Passio, Jesuits, from Goa to China.

1624. The Netherlands open commerce.

1637. The Portuguese hinder English commerce.

1664. Second English opening of commerce.

1680. English factory established at Quangtung.

1682-84. The Chinese occupy Formosa, and suppress some pirates on the coast.

1689. The Russians open commerce.

1692. Imperial decree permitting Christianity.

1693. First Russian embassy.

Nipon, or Japan.

1600. Netherlands first arrive at Tirando; they buy up all the gold for silver.

1612. Severe measures against Portuguese Jesuits.

1613. First English envoy received.

1614. Exile of all Christians to I. of Kuushiu.

1617. Closure of all ports except two.

1622. Massacre of Japanese Christians and others.

1624. All foreigners are banished, except the Netherlands and the English.

1624. The English withdraw from Japan.

1637-39. The Portuguese are re-admitted and banished.

1640. Assassinations at the Portuguese embassy.

1641. The Netherlands are restricted to the I. of Deshuma.

1653. Futile English attempt at commerce.

Korai, or Chosen.

1627. John Wettere, Hollander, is wrecked, and lives for 27 years in Korai.

1653. Hendrik Hemel and the crew of Sparwehr are wrecked, and live for 15 years in Korai.

Sunda Islands.

Amboyna.

1605. The Netherlands expel the Portuguese and form a settlement.

1615. The English establish a factory.

1623. Massacre of English by the Netherlands.

1654. Compensation obtained by the English.

Exploration and Settlement

Sumatra.

1600. Settlement of the Netherlands on the West Coast.

1602. The English visit Acheen.

1649. Factory established at Palang.

1659. An English factory is established at Acheen.

1664. Factory at Palembang

1683. English settlement at Bencoolen.

Java.

1612. Fort Batavia is built by the Netherlands.

1619. The English build a factory at Bantam.

Brunei, or Borneo.

1604. The Netherlands trade at Succadana.

1609. They obtain privileges.

1623. Abandonment of Succadana.

Celebes.

1667. The Netherlands and the English form some settlements.

Ladrones.

1660. First Spanish settlement, about this time.

1667. Second or Spanish Jesuit settlement.

Philippines.

1686. Visit of Laziano to the New Philippines, one of which he names La Carolina.

Banda Islands.

1603. The Netherlands expel the Portuguese.

1603-64. Various English attacks.

Australia, Pacific Ocean, and Indian Ocean.

1602. The Netherlands East India Company is founded.

1603. The Spaniards discover the New Hebrides.

1605-06. Expedition of Quiros from Callao to the Dangerous Archipelago; thence to the I. Sagittaria (perhaps Tahiti), and to Taumaco (in the Duff Islands), thence to one of the New Hebrides, and returned to America.

1606. Expedition of Torres from the New Hebrides to Papua and the Australian Coast to Cape York.

1606. Torres, a Spaniard, passes through Torres Strait.

1615-16. Expedition of Le Maire and Schouten to Le Maire Strait by Staten Island, round Cape Horn to the Isle of Dogs and the Dangerous Archipelago to the Friendly Islands and the Samoa Islands. They coasted Papua from 143° longitude to Geelwink Bay; and thence to Gilolo and Batavia.

1616. West Australia discovered by Hartog.

1618. Discovery of North Australia by Zeachen.

1619. Discoveries of Van Edel in West Australia.

1627. Discovery of South Australia by Hollanders.

1628. Discoveries of De Witt in North Australia.

1642-43. Expedition of Tasman from Batavia to the Mauritius, and to Hendrik Bay in Tasmania; thence to Murderer's Bay and Cape Maria in Staaten Land (New Zealand), and Prince William Islands, along the coast of Papua from Cape Sa. Maria, and returned to Batavia.

1644. Tasman's second voyage to Australia.

1688 c. Visit of Kaempfer, a Westphalian living in Sweden, to Ormuz, Arabia, South India, Ceylon, Java, Sumatra, and Japan; he collected a herbarium; he was a naturalist, historian, and scientist.

1686-96. Visit of Dampier to Mindanao, Manila, the coast of China, the Moluccas, New Holland (Australia), the Nicobar Island, Su-

Exploration and Settlement

matra, Malacca, Tungking, Benkulen.

1697. Visit of Vlamingh to South Australia.

1699-1701. Expedition of Dampier from England to Brazil, the Cape of Good Hope, and the Bay of Sea Dogs in West Australia, thence for 900 miles along the coast, and to Timor; thence to Cape Maho in Western Papua, and King William Island and Schouten Island to S. Matthias Island, Squally Island, and New Ireland. Also the islands of S. Denis, S. John, and a large group of islands near New Britain; thence to the Moluccas, Borneo, and Batavia in Java.

North America.

Voyages.

1603. Voyage of M. de Charles and Samuel de Champalain from Honfleur to the river S. Lawrence, up to Tadoussac and Fall S. Louis. Return to France.

1605. Voyage and exploration of M. de Monts (entitled Governor of Acadia), and Champalain about the mouth of the river S. Lawrence to the interior.

1608-10. Third voyage of Champalain; he founds the future town Kebec (in French spelt Quebec); he defeated some Irokwa near Lake Champalain, and descended the Richelieu River.

1615. Champalain explores the Ottawa River, and land towards Hudson Bay; he built a fort at Montreal, and explored Lakes Huron and Ontario.

1678. Father Marquette discovers the Upper Mississippi River.

1679-80. Expedition of La Sale and Tonti for De Frontenac, Governor of New France, to Lake Erie, Lake S. Clair, Lake Huron to Macmillan Mackinac and Green Bay to the river S. Joseph; where they built a stockade among the Miamis.

He reached the river Illinois, and built a stockade called Fort Crèvecoeur.

1681-82. Second expedition of La Sale from Lake Erie to Fort Crèvecoeur, and the confluence of the Illinois and Mississippi, to the confluence of the Missouri and Ohio Rivers. He built a stockade, Fort Ohio, entered the Arkansas and Natchez countries, and passed into the Gulf of Mexico, 9 April, 1682. He called the great river River S. Louis, and the whole country, 1000 miles long, Louisiana.

1684-86. Third expedition of La Sale from La Rochelle to S. Domingo, Florida, and to the bay S. Bernard, where he formed a settlement.

Arctic Voyages.

1607. Expedition of Henry Hudson from Gravesend to East Greenland in lat. 73°, and to Spitzbergen as far as lat. 82°. He discovered Jan Megen Island.

1608. Second expedition of Hudson to Spitzbergen and Nova Zemlya.

1609. Third expedition of Hudson from the Texel by the North Cape to Nova Zemlya, thence to the Faroe, and to the bay on the coast of America 150 miles wide, in lat. 40½°.

1610. Fourth expedition of Hudson to Frobisher Strait, to Davis' Land of Desolation, to Davis' Strait; he attempted to winter in a large bay, but his crew deserted.

1615. Expedition of Byleth and Baffin to Cape Farewell, Desolation Island, and Savage Island, to lat. 64° in Davis' Strait.

1616. Second expedition of Byleth and Baffin to Davis' Strait, Women's Island, lat. 72° 40', Horn Sound, to lat. 78° at Baffin's Bay; thence to Carey Island, Jones' Strait, Coburg Island, and Lancaster Strait to Cumberland Land, and return to Dover.

Exploration and Settlement

Labrador and Hudson Bay.

1610. Re-discovery of Hudson Bay by Hudson.
1668. Prince Rupert's settlement.
1670. Incorporation of the H. B. Company.
1685. Settlements in 1674, and in 1685.

Acadie.

1604. Port Royal founded by the French in English territory.
1613. The English take Port Royal.
1621. British settlement under Alexander.
1627. Port Royal taken again by the English.
1632. Restoration of Port Royal under Treaty of S. Germain.
1639. French settlements in the New Brunswick part of Acadie.
1654. Port Royal taken the third time by the English.
1667. Restoration of Port Royal and New Brunswick—part of Acadia to France, Treaty of Breda.
1672. Second French settlement in the New Brunswick portion of Acadie.
1690. The New England colonists take Port Royal the fourth time.
1697. Fourth restoration of Port Royal to France.

Newfoundland, &c.

1610. Charter colonising St. John's, Newfoundland.
1615. Charter of the Bermuda I.
1623. Baltimore settlement, third in Newfoundland.
About 1629. British occupation of Cape Breton I.
1632. Cession of Cape Breton I. to France by treaty.
1633. Falkland settlement, fourth in Newfoundland.
1654. Kirk's settlement, fifth in Newfoundland.
Doublet's charter of Prince

Edward's I., called St. John's Island.

1696. Conflicts between French and English.

No French settlement of Isle Royale; apparently none of Isle S. Jean (Prince Edward's I.) in this century.

Canada, or Nouvelle France.

1608. Champalain founds Kebec on the site of Stadacona.
1629-32. British occupation of Canadian lands and of Cape Breton I. under Kirke.
1632. Restoration to France by Treaty of S. Germain.
1642. Ville Marie (Montreal) founded on the site of Hochelaga.
1648. Irokwa incursions.
1663. Fixed government established.
1667. Treaty with the Irokwa.
1670. Detroit, Michigan, founded by the French.
1671. Visit of Perrot to Chicago, Illinwah.
1673. Explorations in Ohio.
1674. Settlements on Rupert's R. and Moose R.
1685. Settlements on the Nelson and Severn R.
1686. French settlements in Iowa.
1690. Phipps' expedition to Kebec, which is fortified about this time.

New England, or Northern Virginia.

1602. Gosnold rediscovers C. Cod, or Keel Cape, the Kiel armes of the Norwegians.
1609. First English settlement of Phippsburg, Maine.
1614. John Smith discovers C. Traga bigsanda, or C. Anne.
1620. Puritan settlement of Plymouth.
1623. First settlement of New Hampshire.

Exploration and Settlement

1628. Salem and Massachusetts Bay settled.

1629. Charlestown, Mass., founded.

1630. Boston founded by Charlestown colonists.

1635. Fenwick's settlement on the Connecticut.

1635. Later English settlements in Maine.

1652. (Yorkshire) Maine is united to Massachusetts.

1688. New York, &c., is recovered.

New Netherlands, &c.

1609. Hudson discovers Manhattan I. and the Hudson R.

1614. Hollanders first settle on the Hudson, and name the settlement New Netherlands. The English of New England declare this an encroachment on their lands.

1623. Fort of New Amsterdam built.

1637. Settlements on the Delaware by Swedes.

1664. Surrender of New Amsterdam to the English.

1664. King Charles II. assigns New Jersey to the Duke of York, who sells his rights.

1667. Formal cession of New Amsterdam by treaty.

1673. The Hollanders retake New York and New Jersey.

1674. Restoration of New York to Great Britain in exchange for Surinam.

1674. Penn purchases part of New Jersey.

1682. Philadelphia is founded by Penn.

1688. New York, &c., is joined to New England again.

1690. Massacre at Shenectady by French and Redskins.

Virginia and Maryland.

1606. Informal separation from Carolina.

1607. First permanent settlement of James Town.

1610-11. Delaware and Gate's settlements.

1621. Constitution of the colony, Virginia.

1622. Massacre by the Redskins in Virginia.

1634. Baltimore settlement of Maryland.

1639. Constitution of the colony, Maryland.

1644. Second massacre in Virginia by Redskins.

1645. Revolt of Maryland.

1689. Second revolt of Maryland.

1692. Maryland becomes a crown colony.

Carolina, formerly Virginia.

1630. Granted by Charles to the attorney Heath.

1660. Second British settlement of the Albemarle colony by refugees from Virginia.

1663. Clarendon charter of Charles II.

1669. English settlement in Southern Carolina.

1672. Sayle founds Charlestown, Carolina.

1693. Abandonment of the old constitution.

1695. Rice cultivation introduced.

Florida Territory.

1600-99. A Spanish colony—unchanged.

Louisiana Territory.

1633. French discoveries.

1673. Various detached French settlements follow the explorations of Ilberville.

1674. The town St. Louis, Missouri, is founded.

1686. Settlement of Des Moines, &c., Iowa.

1698. Settlement of Ship I., Miss.

1699. Organisation of the settlements of the Mississippi Valley as Louisiana.

Exploration and Settlement

Texas, Arizona, California, &c.

1687. Spanish settlements in Arizona and Texas.

1687. French settlements in Texas.

1690. The Spaniards expel the French from Texas.

1698. Spanish settlements in California.

Mejique, or Nueva España.

1603. Vera Cruz is taken by buccaneers.

1609. Slave revolt suppressed.

1624. Civil war about the corn monopoly.

1653. General revolt suppressed.

1659. Campichi taken by English.

1667. Settlement of English at Campichi.

1678. Campichi taken by pirates and buccaneers.

1685. Campichi taken by Grammont's buccaneers.

1692. Revolt of the city of Mejique.

Antilles and Carib Islands.

1630. Western coast of Hayti seized by the French.

1643. British settlement at Belize, in Honduras.

1655. Jaymaca occupied by the English.

1661. Formation of the crown colony Jaymaca.

1670. Formal cession of Jaymaca to England.

1674. English colonists from Surinam settle in Jaymaca.

1690. Puerto Rico taken by the English, but afterwards abandoned.

1693. Building of Kingston, Jaymaca.

1697. Haiti becomes entirely French under treaty.

Madania, or Martinique.

1635. The French seize Guadalupe and Madania.

1674. The Netherlanders attack Madania.

1695. English attack on Madania.

The Lucayos.

1630. The English colonise the Lucayos, which are deserted.

1641. The Spaniards destroy the Lucayos colony.

1666. Second English settlement of the Lucayos.

Domenica.

1688. The English seize Domenica.

Trinidad.

1676. The French take Trinidad, and restore it.

S. Lucia.

1639. English settlement, which is afterwards destroyed by the Caribs.

1650. French settlement.

1650-99. Disputed possession.

Barbados.

1605 and 1614. English settlements.

1652. Civil war of the royalists.

S. Christopher (Lianniga).

1623. English settlement of Warner.

1625. Buccaneers attacks, and French attacks.

1690. Disputed possession, and recovery.

Antigua.

1627. Carlisle settlement.

1666. French attack.

Maria-Galante.

1647. French settlement.

Montserrat.

1632. British settlement.

1664. Taken by the French.

1697. Restored to England by treaty.

Nevis, or Nieves.

1628. English settlement.

Anguilla.

1632. British occupation.

1650. Settlement reformed.

S. Bartholomew.

1648. French settlement.

1699. British capture and occupation.

1697. Restored to France.

Exploration and Settlement

S. Eustatius.

c. 1620. Netherlands' settlement. Frequently taken and restored in this century.

Tobago.

1632. Settled by the Netherlands.

1683. Disputed possession; abandoned.

Granada.

1652. French settlement; and extermination of the Caribs.

S. Vincent.

c. 1624. English settlement.

1672. Included in the United Islands (British).

Tortola.

1648. Settlement of Netherlands.

1666. British capture and occupation.

Barbuda.

1628. English settlement.

Saba.

1640. Settlement of Netherlands.

S. Thomas.

1672. Danish settlement.

South America.

New Granada, &c.

1634. The Hollanders take Curaçao.

1670. Morgan's buccaneers attack Puerto Principe, Portobello, Maracaibo, S. Antonio de Gibraltar, La Rancheria, Island Catarina, and sack Panama.

1697. Pointi's buccaneers take Cartagena.

Guiana.

1604. First French settlement at Cayenne.

1617. Raleigh's exploration for gold mines; his lieutenant, Smith, sacks S. Thomas in his absence, and without his order. Raleigh is beheaded for this.

1621. Slave labour introduced.
1634. English settlement near Berbice.

1650. The English take Surinam.

1654. The English take Cayenne.

1664. Restoration of Cayenne by the English.

1667. The Netherlands recover Surinam.

1669. The English retake Surinam.

1674. Surinam restored by exchange for New York.

1690. French attack on Berbice.

Brazil.

1615. Pará (Belem) founded by Caldeyra.

1624. Bahia taken by the Netherlands.

1630. Olinda, and the province Fernambuco, taken by the Netherlands.

1654. Vieyra restores Portuguese rule.

1661. The Netherlands resign claims to Brazil.

Peru.

About 1643 (?). Callao is founded.

Paraguay.

1690. Mandate from Spain allowing the Jesuits full power.

La Plata.

1665. Establishment of a royal audiencia at Buenos Ayres.

Chile.

1600-99. The Araucanian wars continue throughout the century.

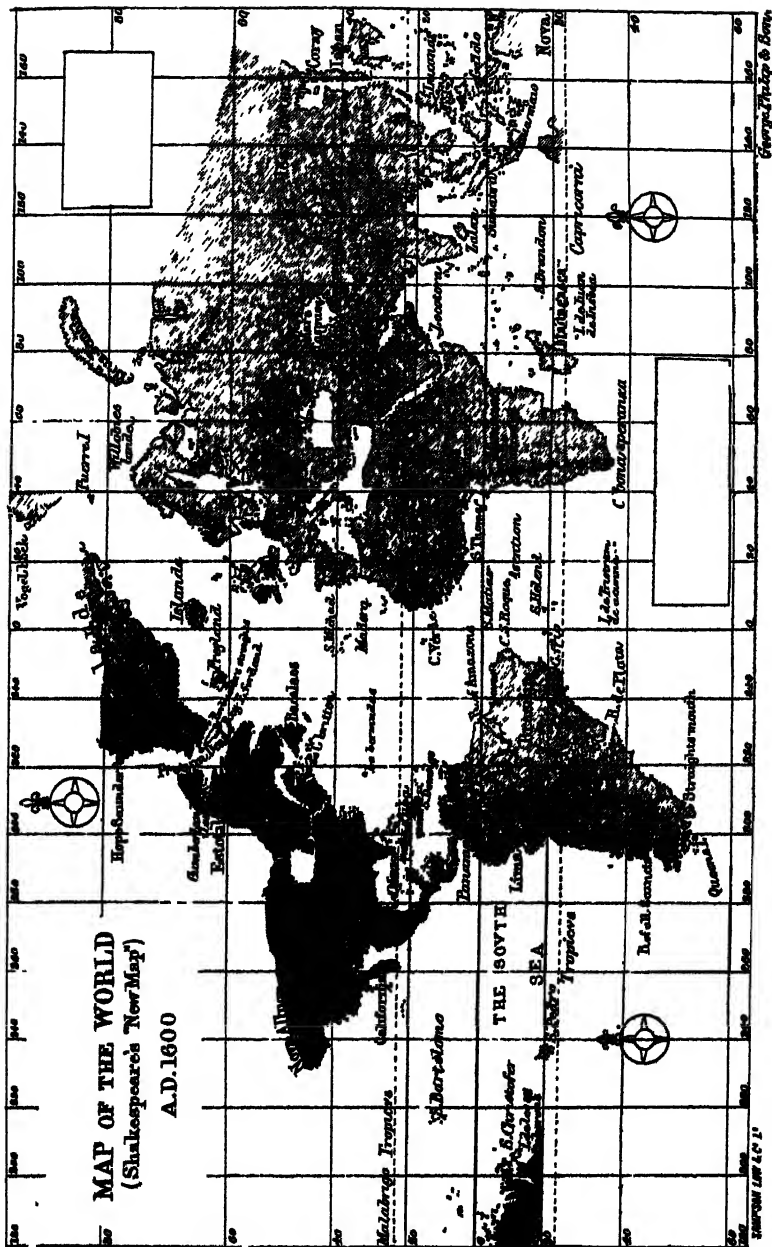
Patagonia and Falkland Islands.

1600-99. No explorations recorded.

1616. Le Maire and Schouten pass C. Horn.

1689. Visit of Strong to the Falkland I.

A.D. 1600



EIGHTEENTH CENTURY

1700 TO 1799.

PERIOD OF ENGLISH COLONISATION

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EIGHTEENTH CENTURY

1700 TO 1799.

PERIOD OF ENGLISH COLONISATION.

GENERAL DEVELOPMENT.

THIS was a century of progress ; the general development being markedly greater than in any preceding century, taken on the whole. It may, however, be noticed that the greater part of the progress was achieved by England in the first instance ; even if much allowance be made for deficiencies of record from other countries. Italy and France were next in order ; then Germany fourth ; while Spain, and even the Netherlands, were in the background. Italy, the leading inventive nation of Europe from the thirteenth to the fifteenth century, both inclusive, and perhaps for nearly four centuries instead of three, was no more *facile princeps*. Not that she had fallen back very much, but other nations had come forward. Since 1475 England, and since 1674 France, had become progressive to a far greater degree than before. Nor is the evidence of deficient record the only basis of the assumption ; for if we turn to the political history of the time, the causes may be easily deduced. But that subject will be dealt with under the head of Political Condition.

There were also other causes for the relative change. Italy had no colonies, and had become rather cramped and partly isolated ; it had no Asiatic connections ; whereas in former times it had drawn introductions from the Byzantine Greeks, from the Moslems of Tunis, Berberland, and Egypt, while Venice and Genoa had large Levantine commerce, which also partly came from Egypt and Asia. On the other hand England, always second to Italy's first, and even first in the gloomy tenth and eleventh centuries, had expanded steadily and greatly.

France was coming forward as a great nation after its Period of Grandeur under Louis XIV., and markedly encouraged invention and progress in individuals, instead of leaving them to suffer, in the English fashion, for their labours and good works. Spain had collapsed much while France was rising. The Netherlands had suffered from Imperialism, and never regained its former position. Germany had never risen as a progressive nation ; its political and religious difficulties were enormous, and restrained it. Also there was the special drawback that Latin, not German, was kept as the exclusive language of science, and even of books of information, till the close of the seventeenth century ; a practice first opposed by Thomasius in 1688. In France and in England the vernacular had long been used ; in Italy, Latin had always been comprehensible without learning it ; but in other countries the use of Latin had been a great drawback. Italy always had patrons of science and art ; any Italian who did or wrote anything skilful and scientific was at once given a professorship and a livelihood, apart from all other considerations ; but such patronage was now less than before ; able men were forced into priestly office to gain bread, their prospects were blighted, and progress was checked. France, on the contrary, with its lately increased prosperity, was well able to encourage progress, and sometimes did so.

Geographical discovery did not add many new introductions or advantages to the common stock already gathered. It was an age of colonising settlements, in which the English took the lead, and managed to hold it under great difficulties. It was also a period of relatively continued war in Europe, and the drain on the resources of most nations must have been too severe to spend much at home.

The financial conditions under which nations went to war were deplorable ; Marlborough did much at his own expense ; generals depended not on national funds, but on their own treasure chests ; officers paid enormous sums for promotion, and supported their men to some extent ; sometimes they were destitute, both French and English, as the records of the campaigns in America prove. It was a grand financial novelty of the French Republic to issue assignats and go to war with continuous unfailing support ; well armed, well provided, and with limitless reserve of funds, they could easily overrun Europe. And their generals acquired their military skill during this experience, while the mere troops thought

themselves nearly invincible. Their successes showed that the financial and military-financial systems of all Europe were wretchedly mean until that period. As an extreme case, in the English navy the commanders had to pay for the painting of the ships, and for many such things, when the navy was the safeguard of the country. If the Funding System had been adopted, and Public Banks established, it was yet on a very petty scale, and the supply of the public wants had not been thoroughly studied.

The sciences took large strides. Astronomy was supported in several public observatories. Halley, Bradley, and others, added much to its scientific knowledge; and Maskelyne proposed that valuable annual, the 'Nautical Almanac,' first issued in 1767. The French and the Germans also did much in scientific investigation; the new observatories were those of Berlin, 1711; St. Petersburg, 1725; Padua, 1769; Oxford, 1772; Edinburgh, 1776; and Dublin, 1785.

The noteworthy astronomers were the following:—James Bradley, 1692 to 1762; Johann E. Bode, 1747 to 1826; Cagnoli, 1743 to 1816; Cæsar Cassini, 1714 to 1784; Frisi, 1727 to 1784; George Graham, 1675 to 1751; Maximilian Hell, 1720 to 1792; Edmund Halley, 1656 to 1742; William Herschel, 1738 to 1822; Lacaille, 1713 to 1762; Lalande, 1732 to 1807; Laplace, 1749 to 1827; Tobias Mayer, 1723 to 1762; Nevill Maskelyne, 1732 to 1811; Mechain, 1744 to 1805; Monnier, 1715 to 1799; Piazzzi, 1746 to 1826; Pingre, 1711 to 1796; Reggio, 1743 to 1804; Robins, 1707 to 1751; William Wales, fl. 1768, d. 1798.

One of the most marked separations of this century is that of the geodesists, who also were practical astronomers, from the theoretical and permanent astronomers of fixed observatories; hitherto there was much needless blending of such matters. The result of the offshoot from the expansion was to form a useful class of astronomers that were also geodesists and topographers, though permanent astronomy became work more of routine order than before, thus requiring a lower degree of skill and capability. The French geodesists were more specially a separate class, as Bouguer, Lacondamine, Joseph Jussieu, Lamennais, Maupertuis, Frezier, Pierre Lemonnier; and unfortunately not represented in England, which confined its efforts to simple topography and to navigation, a branch in which it excelled at this period. Italian navigators hardly existed, while French navigators were few.

Botanical knowledge was equally well supported by newly-founded physic gardens and botanical gardens: those of Karlsruhe, 1715; Kew, 1730; Chelsea, 1732; Schoenbrunn, 1753; Madrid, 1755; Cambridge, 1763; Calcutta, 1768; Coimbra, 1773; St. Petersburg, 1785; Dublin, 1790; and Gand, 1797. In England the botanical introductions of fruit trees, flowering plants, and edible vegetables from distant countries were quite as numerous this century as in the sixteenth and seventeenth centuries; but the rage for botanic classifications was specially French and Swiss.

From the time of Tournefort down to that of De Candolle, a series of French botanists proposed new classifications; and it seems that most of these were not travelled botanists of extended range of experience, but merely local botanists in positions analogous to that of a nobleman's gardener in England. In fact, after the time of De Candolle, in the nineteenth century, Robert Brown, 1773 to 1858, proposed a new classification; hence finality had not arrived even then. Among the naturalists and botanists of this century were Abilgaard of Copenhagen, zoologist, d. 1808; Adanson, 1727 to 1806, botanist in Senegal; Boerhaave of Voorhoet, 1668 to 1738, fl. 1715, qotanist; Buffon, 1707 to 1788, naturalist; Camper of Leyden, 1722 to 1789; Donati, 1717 to 1762 in Asia; Fabricius of Sleswik, d. 1807; both of whom were naturalists; Forskal, the Swede, 1736 to 1763, naturalist of Arabia and Egypt; Gmelin of Tübingen, botanist of Siberian flora; Albert Haller, the Swiss, 1708 to 1777; Hedwig, 1730 to 1799, botanist of Gramineæ and Cryptograms; three men of the family De Jussieu, of whom two were local botanists, the third, Joseph, had thirty-six years' botanic research in South America, 1704 to 1779; Lamarck, a local French botanist, 1744 to 1829; Latreille, entomologist and writer on crustaceæ, 1762 to 1833; Levaillant, naturalist of Guiana, 1753 to 1824; Karl von Linné, the naturalist, 1707 to 1783; Lyonnet of Maestricht, entomologist, 1707 to 1789; Micheli, 1679 to 1737, botanist of Europe; Moro, on fossil crustaceæ, 1687 to 1764; Mueller of Copenhagen, writer on animalcules, 1730 to 1784; Olivier, 1756 to 1814; Pallas, 1741 to 1811, Russian botanist and entomologist; Pennant, 1726 to 1798; Pignotti, 1739 to 1812; Scopoli, 1723 to 1789; Seguiet, botanist, 1703 to 1784; Sonnerat, botanist of Southern Asia and Madagascar, 1755 to 1814; Spallanzani, 1726 to 1799; Thunberg, fl. 1770 to 1798, naturalist of Japan, the Cape, and Ceylon; Tondi, a

travelled naturalist, who wrote on forestry, 1762 to 1835, fl. 1787; Vaillant, fl. 1717; Waller, 1709 to 1780; and Zanoni, the viticulturist, 1696 to 1770.

Chemistry, in its more extended form of a useful and sure science, was the creation of this century, as the record for this century, on page 245, shows by comparison with all such foregoing records. The Germans, French, and English, divide the honours of it.

The starting point, the discovery of oxygen, was English, also the basic discoveries made by Cavendish, Priestley, and Black; while the metallic separations, after those of arsenic cobalt, platinum and nickel, were partly due to the principle of Swab and Cronstedt, blowpipe analysis. The history of the past had indicated the quarters in which this development might take place. The two mining nations were Britain and Saxony, in early times; and though the Yorkish Civil War had swept away so much knowledge that Saxon Germans were encouraged by Queen Elizabeth to work mines and ores beyond the English skill of that period, it is evident that this loss of knowledge was replaced to some extent. Thus the two mining nations were those that contributed most to the original creation of chemistry as a science in this century. Curiously also, oxygen seems to have been the starting point in science, and appears also to be the original element of which other substances are but modifications.

Geology in this century was hardly a science, certainly not in England till the time of William Smith, b. 1769, d. 1839. There were some speculative theories, only partially correct, and fossils had been discovered and classed in some way since the time of Fracastoro, who flourished in 1517; but the science had not yet been established on firm and comprehensive bases. Though geologists were floundering, there were yet many laborious workers; among them were Brocchi, 1772 to 1826; Fabbroni, 1752 to 1822; Moro, who wrote on fossil crustaceans, and proposed a volcanic theory, 1687 to 1764; Edward King about the same time; De Saussure, mineralogist, 1749 to 1799; Waller of Upsal, mineralogist, 1709 to 1780;—also Arduino, the voluminous, 1714 to 1795; De Dolomieu, 1750 to 1801; Hutton, 1726 to 1797; Pini, 1740 to 1825; Soldani, 1733 to 1808; Werner, the mineralogist, 1750 to 1817; and last, William Smith, the father of English geology, and in fact of all modern geology.

Mathematics received many accessions of scientific know-

ledge; but the seventeenth had been the specially mathematical century as regards new and useful discovery.

In the eighteenth the progress chiefly consisted in developing the calculus, and applying it to functions of various sorts. The course had been this. The earliest proposer of indivisibles and fluxions had been Buonaventura Cavalieri, b. 1598, d. 1647; and the earliest introducer of the principle of infinity in geometrical matters had been Kepler, b. 1571, d. 1630. But the earliest real inventor of the use of infinitesimals was, undoubtedly, the Englishman, John Wallis, b. 1616, d. 1703, who also wrote on mechanics and algebra; his works were, 'Arithmetica infinitorum,' 'Mathesis universalis,' 'Mechanica,' and his 'Algebra.' Following him was Isaac Barrow, b. 1630, d. 1677, who knew the differential triangle, as well as other such matters, which he taught to his pupil, Newton. Baron Leibnitz, and Newton more especially, developed and utilised the calculus; afterwards the French and others took up the subject, leaving the matter imperfectly developed at the close of the seventeenth century. Even then Viviani, b. 1621, d. 1703, who wrote on maxima and minima, did not apply the calculus in them, or at least not in his earliest work, or in any of them available now in England. In the eighteenth century, Brook Taylor, b. 1685, d. 1731, wrote his 'Methodus incrementorum directa et inversa,' 1715 to 1717, which included his Theorem, as well as the development of the calculus. Thomas Simpson, b. 1710, d. 1767, wrote on fluxions in 1737. John Bernoulli, b. 1667, d. 1748, the teacher of Euler, also a Swiss, developed the calculus in exponential and rational fractions. Euler, b. 1732, d. 1812, extended the application in circular functions, and applied the calculus in mechanics, the laws and knowledge of this branch being few and small at this time. Benjamin Robins, b. 1707, commented on these applications of Euler. Giuseppe Lagrange, b. 1736, d. 1813, re-wrote the calculus in algebraic form, and formed developments on the basis of Taylor's Theorem; he also began a new branch, 'The Calculus of Variations.' Mascheroni, in 1785, applied the calculus to the equilibrium of vaulting; and Zendrini, in 1679 to 1742, had introduced the calculus in Italy. In the face of such a record, and taking into consideration the probability of several unmentioned developments in England during this period, it seems clear that modern mathematics was of English origin and development. Other mathematicians of this century were Cagnoli, 1743 to 1816; Ruffini, who wrote on algebraic

equations, fl. 1798, b. 1765, d. 1822; Klugel, b. 1739, and his collaborators in the *Math. Worterbuch*, Velthusen, Henke, Bruns, and Crell; Intieri, 1680 to 1757; Lacroix, 1765 to 1843, who used the calculus; Legendre, fl. 1782, b. 1752 to 1833; Riccati, 1676 to 1754, who wrote on indeterminate coefficients and powers. Also Daniel Bernoulli; Petronio Caldani, 1735 to 1808, who wrote on logarithms of negative numbers; Alexius Clairaut, 1713 to 1765, who solved the problem of three bodies; D'Alembert, 1717 to 1783; Charles Hutton, 1737 to 1823; Lacaille, 1713 to 1762; Johann Lambert, 1728 to 1777; Maseres, 1731 to 1824; Montucla, 1725 to 1799; Pessuti, 1743 to 1814, who wrote on spherical trigonometry of a new sort; De Prony, 1735 to 1839, who wrote on mechanics and hydraulics, Robins, who also wrote on mechanics; and Wolff, 1679 to 1754.

Scientific instruments and appliances followed much the same course as modern mathematics; the novelties of the seventeenth century were followed by developments and modifications in this century. In the telescope, Hadley improved the Gregorian instrument in 1718; Molyneux made other improvements in 1738; Hall and Chester Moore invented achromatic telescopes in 1729; but this invention is also assigned to Euler, b. 1707, d. 1783; the most useful invention of a lens-making machine is due to Toffoli, d. 1793. In clocks and chronometers, Graham invented the compound pendulum, 1675 to 1751; Leroy invented horizontal watches, and other new movements, 1686 to 1759; John Harrison improved chronometers in 1767; Breguet invented improvements in clocks and chronometers, a sympathetic pendulum, and an astronomic regulator reading to hundredths of a second, in 1780; Borda invented an exact pendulum measurer in 1789. In goniometric instruments, Hall and Godfrey improved the quadrant in 1731; Borda the repeating circle about 1736; and mikrometers were invented by Bouguer 1740 c., Boscovich, 1758, Ramsden, 1767, and Cavallo, 1792. In other, and especially in astronomical instruments generally, the inventors were Graham, Robins, and Ramsden, in England; Lemonnier and Regnier, in France; and Toffoli and Cavallo, in Italy.

Among other instruments there was the odometer of Toffoli; the dynamometer of Regnier; the eudiometer of Volta; the areometer, with the improvement of Nicholson; the pyrometer of Musckenbrock, improved by Smeaton; the torsion balance of Coulomb; and the intensifying parabolic reflector of Lenior

and Borda. Among meteorological instruments, there were the mercurial thermometers of Fahrenheit, 1724; of Reaumur, 1731; and the sensitive metallic thermometer of Breguet, 1780; the hygrometer of De Luc and De Saussure, 1783, and that of Smeaton, 1792; other instruments being also invented by De Saussure.

Electricity was still in its early stages. Galvani and Volta had achieved much of the basic work, but it was still the philosophy of the study, until the close of this century. Two electromotors were known; and telegraphy had been begun, at Geneva by Le Sage; afterwards in France, under Claude Chappe. Ramsden also made some improvements in electrical machines. Curative magnetism seemed firmly established, but the disappointments in connection with Mesmeric schools thwarted its progress. The ignorant mob thought that curative power was to be learnt like arithmetic or blowing glass bottles: an unfounded notion of equality had crept into the subject, and the vain disciples thought that if Mesmer would only teach them the mode, they would then be his equals in curative power. The principle was known anciently in India, and the power was there imagined to exist only in a few specially favoured holy men; the subject was kept very secret, and the power was considered rare; yet there is no doubt that the power was transmitted to some degree in certain specially selected cases, where the germs of power were known to exist. In England, Greatorex had in the past century been successful, but apparently had not left any school of followers. Similarly in this century in France, Germany, Austria, and Italy, the power was not handed down with the theory of method. Apart from animal electricity, curative magnetism, by currents from metals and inorganic substances, was also commenced in this century. Doubtless some good was done in some cases, though the modes of application must have been much at random, for neurology was a new science that very few had yet studied, and a current, whether concentrated or not, when injudiciously directed, must have been as hazardous as a lottery. The leading facts in the progress of electricity in this century will be found in a special record, among the special branches.

The application of steam received a few useful starts, in the condenser, the steam loom and mill, the locomotive, and the steamboat. The invention of the steam-engine belonged to the seventeenth century; and it seems surprising that these or other early applications did not follow sooner, when we

contemplate the enormous after-development of the use of steam in the nineteenth century. If it be asked whether things could have been otherwise, the answer would be, undoubtedly: Laboratories could have been established by governments, materials and workmen provided, rewards promised to all successful designers and useful theorists, not to some selected solitary one; and a school of useful inventors could have been formed. A century would have been saved; the development of 1851 might have been achieved in 1751. By analogy, the progress in France in Fine Art due to early State encouragement certainly advanced that country by about a century beyond England in that branch of progress.

Proceeding to other and older branches of physics, Coulomb wrote on several of them; Euler wrote on light, friction, cohesion; Frisi on hydraulics; Nicholson, Papini, Priestley, who wrote on sound, light, colour, respiration, &c.; Reaumur and Saunderson, who wrote on light, colour, and the rainbow before 1739; also Arduino; d'Azara; John Bernouilli, who wrote on elastic fluids; Beccaria, who discovered double refraction; Renaud Haüy; Etienne Malus, who experimented on polarised light; William Molyneux, who wrote on dioptrics; Tobias Mayer, who wrote on colour and magnetic variation; Parmentier; Pemberton; Poleni, the meteorologist; Pallas; and Pessuti; Robins; Stahl, and Tondi. Even if this list be extended, it would yet remain comparatively small, for the decline of the older branches of physics seems to have been coincident with the rise of chemistry and mathematics; the less exact sciences were falling into the domains of that strange class, that always existed and always will exist, the pseudo-philosopher. Sententious twaddle with much assumption, combined with startling tricks, has always been popular; and the mob seldom knew or cared much about the subject and its treatment, for folly and science were undistinguishable to them. 'The love of seeing a complimentary fellow "wagging his paw in a poopit" has always been a curious weakness of the brainless; and probably the feeling is analogous to that of those who can long watch the recurring movements of automata with pleasure, or delight in the churned music of mechanism.

The miscellaneous inventions of this century have an intrinsic value, and capacity for further development that are striking at a mere cursory examination. The philosopher of preceding centuries had contented himself with establishing a new principle, and making a small model to be examined in

his laboratory; the inventor of this century had to do much more to prevent the result of his toil from being wasted. There was no set of officials appointed to ferret out the inventor and thoroughly examine his result; to purchase it for the State, or to promise purchase when further perfected; nor even to act as intermediaries with speculative investors and companies. The inventor had to make a weary search, not only for unrighteous mammon, but for those capable of understanding him; and such were few. The patronage of science was still deemed kin to almsgiving; and while such notions lasted, progress was scant. Taking some examples—Clayton discovered the use of illuminating gas in 1736; but the principle was not adopted by the public till about 1798. Aimé Argand's invention of a lamp was confiscated by an Equality mob in France. An English patent for compressed oil gas in 1792 was never taken up or utilised till 1871, and then in Prussia. Aloysius Senefelder, with his Bohemian invention of lithography, tramped Europe in distress, and perhaps benefited little from it at last in England. Yet curiously the cultivation of indigo was encouraged by premiums in Carolina in 1747; and bubble speculation was a marked feature throughout the century in France and England. A few cases of the before-mentioned type were enough to deter hundreds. Even in the extreme case, the invention and establishment of lifeboats at British ports, for saving life in cases of wreck, there was no State encouragement, and such things were made dependent on public almsgiving and contribution; yet the public were taxed by the State to maintain bridges and roads; and a headsman for destroying life was a paid official. If any principle for limiting State assistance be sought, there is only one to be found, that of shirking wherever possible. In this century, and nearly till the twentieth, abstention was the chief vice of Governments, and was termed adherence to the voluntary principle, while anything like action or help from the State was termed a great concession; of all the powers of former despotisms, repression alone remained to modern monarchies. Perhaps ancient tyrannies were better on the whole than parliaments of tradesmen with their penny-wisdom.

Anatomy in this century took new courses of development. If down to this time it had been a branch of natural history or zoology, in a special class of science valuable to all, at this time it fell more into the hands of surgeons as if theirs by exclusive right. The new branch, pathologic physiology, was

seldom explored by others; and thus the knowledge of simple osteology, myology, neurology, and comparative anatomy, and physiology, sciences useful to all, became more and more confined to a class. The interest in these subjects hence diminished. Among the more noteworthy anatomists of this century were Albino, who wrote on the vascular system of the intestines, 1696 to 1770; Paul Barthez, the physiologist, 1734 to 1806; Bayle, the pathologic anatomist, d. 1815; Blumenbach, the craniologist, fl. 1791; Baron Boyer, fl. 1797, the cyclopædist; Comparetti, the comparative anatomist, 1746 to 1801; Cotugno, the discoverer, 1736 to 1822; Cullen, the physiologist and writer on nerve treatment, 1712 to 1790; Gall, fl. 1796; Albert Haller, b. Bern, 1708, d. 1777; the human physiologist and writer of 150 works; John Hunter, 1728 to 1793, comparative anatomist and inventor of some operations; Robert Jackson, physiologist and writer on the fevers of Jaymaca and the Antilles, b. 1751; Edward Jenner, b. 1749, fl. 1798, d. 1833; John Latham, anatomist, 1740 to 1837; Lyonnet of Maestricht, 1707 to 1789; Malacarne, fl. 1780, who wrote on encephalotomy, and made several discoveries; Mascagni, who made lifesize anatomical plates, and a special work for artists, 1755 to 1815; Meckel of Wetzlar, 1714 to 1774; Alexander Monro, the neurologist, 1697 to 1767; Monteggia, the surgeon, 1762 to 1815; Morgagni, 1681 to 1771; Nannoni and Paiola, operative lithotomists; Palucci, 1719 to 1797, the operator for lachrymal fistula; Pelletan, the clinic and operative surgeon, 1747 to 1829; Antoine baron Portal, 1742 to 1832, the pathologic physiologist on living subjects; Quesnay, 1694 to 1774, who wrote on physiocracy and animal economy; Scarpa, fl. 1789, who improved the operation for cataract, and wrote neurologic tables and many anatomical works; Spallanzani, 1726 to 1799; Tabarrani; Testa, who introduced physiologic pathology in London in 1787; Toffoli, who discovered a mode of preserving the consistency of the brain during dissection, and made an immense model ear, 1755 to 1834; Vacca-berlinghieri, the hygienist, fl. 1781; Valsalva, the aurist, 1666 to 1723; Vicq d'azyr, the physiologist and cowdoctor; and Walter of Konigsberg; also Fothergill, the originator of the great discovery of suspended animation.

The study of Oriental languages, revived by a small number of men from a philologic view in the seventeenth century, now became more extended with the aim of acquiring knowledge,

through translation. In the Aryan languages, Indian, and Zend, the extension of British power in India near the end of this century favored the introduction of their study; hitherto unknown. The leaders in Arabic and Sanskrit were the following:—

Arabic, Syriac, &c.

Eusebius Renaudot, *f.* 1733 — transl. Moslem travels of the ninth century.

Johann Reiske, *b.* Zoerbig 1716, *d.* 1774 — lived at Leipzig — transl. Arabic MS. of the Leyden library.

Joseph Assemani, Maronite, *d.* Rome 1768 — transl. Arabic and Syriac MS. of the Vatican library.

Bernard de Montfaucon, *b.* Soullage 1755, *d.* Paris 1741 — phil. Coptic, Syriac, and Arabic.

Albert Schultens, *b.* Groningen 1686, *d.* 1750 — transl. the works of Al Hariri.

Rinaldo Carli, *f.* 1766 — transl. the chronology of Haji Kalfa.

Bernard von Jenisch, *b.* Vien 1734, *d.* 1837 — transl. Arabic, Turkish, and Persian.

Michael Casiri, *b.* Tripoli 1749, *d.* Madrid 1791 — transl. Arabic MS. of the Escorial.

Rampoldi, *b.* Milan 1761, *d.* 1836 — transl. much; writer of the Moslem Annals.

Aryan and Chinese.

Sir William Jones, *b.* London 1746, *d.* 1794 — transl. the Laws of Mannu and other works; founder of the Jonesian system of transcribing Oriental languages.

Sir Charles Wilkins, *b.* Frome 1749, *f.* 1780, *d.* 1839 — transl. the Mahābarata, and Laws of Mannu (unedited); the Hitopadesa of Vishnu Sarma.

Carey and Marshman — transl. the Mahābarata and the Rāmāyāna.

Anquetil Duperron, *d.* 1743 — transl. first the Zend books.

Kleuker, *b.* Osterode 1749, *d.* Kiel 1827, *f.* at Riga 1776 — transl. the Zendavasta.

Gaubil, *b.* 1689, *d.* Peking 1759 — transl. the works of Chu King from Chinese.

Giuseppe Hager, *b.* Milan 1757, *d.* 1819 — philol. of Chinese; wrote a dictionary.

Education generally was collegiate, and of the old stamp; dead languages and long dead authors, taught in antique buildings by musty, ecclesiastical pedants. There was, perhaps, already a plethora of universities in Europe, for comparatively very few new ones were founded in this century. In the colonies, education was well cared for, as the following colleges founded in this century show: Yale Coll., Conn., 1701 and 1717; Philosophical Coll., Philadelphia, 1740; Harvard's Coll., N. Eng., 1741; New Jersey Coll., 1746; Columbia Coll., New York, 1750; Pennsylvania Univ., 1755; Brown Univ., R. I., 1764; Dartmouth Coll., N. H., 1769; Rutger's Coll., N. Jer., 1770; Hampden Sidney Coll., Virg., 1774.

The new libraries and museums of Europe were few; but the new academies and societies were numerous—thrice those of the past century. Even in America, after the separation, several academic associations were founded in this century.

Construction and building now entered fairly into its modern groove. Useful public buildings were built of larger size and in greater numbers; and public works entirely ceased to be rarities. Canals and stone bridges were numerous and large; and on comparing lists of public works and buildings built in the leading countries of Europe, a strong general similarity will be noticed. Iron bridges began in England; and in France Perronet improved the designs for them in stone, foreshadowing future spans of large size. Groignard also made larger basins. In England the very numerous list of canals is the only special feature of this century; and when we reflect on their present neglected state, and the large number of persons ruined in English canal speculation at their construction, it becomes a matter of regret rather than of pride.

In fortification, De Montalembert invented a new system; the field ambulance of Larrey was also new. Fawcett and Guibert wrote on military tactics; John Clerk on naval tactics.

In naval construction, if the English naval records can be believed to the letter, there must have been much done; but the quality was sometimes very inferior to that of the French war-ships, for the English commanders preferred French ships for better sailing qualities; besides, it is very likely that the English records of the number of ships kept up in the Navy were very misleading. For ordinary purposes of sea passage of travellers rather small sloops were in use till near the end of the century.

In mechanical construction, the making of improved looms, and machinery for various factories of new sorts, was a marked feature in England; but if our records with regard to other countries do not indicate any near approach to such works, it may be due to defective information, or to the more likely cause, that the chronic state of war on the Continent impeded all such matters, and left them nearly in the condition of the century before.

In the Fine Arts of this century, Italy no longer kept the lead exclusively. German music rose. The works of Bach, Graun, Haendel, Hasse, Glueck, Mozart, Forkel, Weber, Haydn, Kalkbrenner, Beethoven and Pleyel established a purely German school, comparatively new in Europe. The

Italian composers, however, were still numerous and excellent, both in operatic and sacred music. There were, Ariosti, Buononcini, Lotti, Pergolese, Porpora, Feo, Marcello, Scarlatti, Leo, Gasparini and Durante in the earlier part of the century; and Anfosse, Boccherini, Cimarosa, Guglielmi, Giardini, Jomelli, Paisiello, Nardini, Piccini, Fenaroli, Sacchini, and Traetta in the latter part. The French and English composers of note were few. There were Rameau, Favart, Mehul, Gossée, also Arne, Abell, Arnold, Croft, Boyce, William Jackson, Wesley, Lindley, the English series being mostly writers of ponderous organ or church music, with some heavy glees; but Arne, Burney and William Jackson wrote operatic music of some sort.

In Painting and Sculpture, the Italian artists were numerous, but not better than in the seventeenth century; apparently the more extensive employment of photography did not improve their pictures, if we judge from Canal, or, as he was often called, Canaletto, and from their figure subjects; in fact they seem to have been cramped by it. Their sculptors however maintained their reputation of the last century. The rise of good painting in England was very marked, there were at last some excellent painters:—Gainsborough, Lawrence, Reynolds, Opie, Northcott, Thornhill, West, John Jackson, Morland, Ramsay, Richard Wilson, Barry, and others; and this rise was earlier than that of the French, who afterwards surpassed them. In fact the good French painters flourished near the close of the century, Greuze, Doyen, Vien, Claude Vernet, Gerard, David, Antoine Vernet, &c. But the French had sculptors of merit, as Pierre Legros, Lambert Adam and others, while England had none of any note.

There were many poets and dramatists in this century in all nations, but the general falling off in quality of their doings is very marked.

POLITICAL CONDITION.

The wars of this century were due to the restless ambition and greed of certain nations. Europe had not yet learnt that the intrinsically best condition for its series of nations was a settled one, under which the balance of power could be easily preserved. The pretexts under which war was made were often very flimsy; and several wars would have been thought needless by others than those hoping to gain from them.

There were new upstart powers in Europe, and if on this account alone inferior to the older, longer tested, powers, they had yet fairly earned their new position. The new powers were Sweden, Prussia, Russia, and the Ottoman Empire. The last alone was without excuse for having invaded Europe, though the illtreatment of Ottoman envoys caused much of their later wars. Politically, it had occupied a nearly empty space in Europe, that of the treacherous Greeks of the Lower Empire who had appealed in vain for European help; it had also replaced an inferior morality by a better one, as the Ottoman was more honest and truthful than the modern Greek. Russia was comparatively new, and had earned its position by throwing off the yoke of the Mughal and supplanting him, without any help from Pohlen or from Europe. Sweden had an obscure and dubious beginning; a small portion of Danish territory had been inhabited by specially quarrelsome Swedes and Goths, who strove and fought for centuries, and were hence left to settle their disputes. After ages they agreed on a succession; they were nominally united to Denmark, but afterwards were never at rest. Swedish rebellion was chronic. At last they were left alone again; but their grasping disposition made them very bad neighbours, and they annexed Scania, to which they had but shadowy claims at any time. But Sweden had placed herself before Europe as an effective fighting power in the seventeenth century, during the Thirty Years' War, and afterwards; her position had been earned, and there was little valid excuse for attacking and attempting to dismember her. She was a useful

addition to the number of the Northern powers, and was relatively replacing Pohlen, a selfish and turbulent nation, composed of Jews to a great extent, whose proper habitat was either Babylon or Egypt. The series of wars against Sweden in this century was a collective error, chiefly of Denmark and of Russia; while Pohlen met with its deserts. Prussia was a very new country, an expanded electorate of Brandenburg; but it had not only earned the territories of Prussia and East Pommern, but also the praise of Europe. The colonies of Brandenburg were the lands recovered from the Pagans by the Teutonic knights, and these helped Brandenburg to the position of a kingdom. The partition of this kingdom was the aim of Europe; Prussia had only one ally, England, whose colonies were threatened, though there would not then have been any irrecoverable loss from their partial abandonment. The Seven Years' War is historically engraved in the hearts of both these nations. May the bond of the past always outweigh hopes of political convenience!

Pohlen was one of the older nations, that after long and chronic fits of anarchy had at length attained its culmination, through the later union with Lithuania; it had never helped Russia, but had aimed at subjugating and annexing the Russian duchies. It had done some good in opposing the Ottomans, but was often ineffective. The partition of Sweden had been its object, and the result of the attempt recoiled on itself. The portions of Pohlen after two dismemberments were so turbulent that the final partition was necessary. Russia and Sweden were suitably revenged, and Christian Europe was saved from the possibility of having the Laws of Moses enacted in its midst.

Cursorily noticing the wars of this century that fully occupied the great powers of Europe, they were these. That of the Bourbon succession in Spain from 1701 to 1713 was necessary for preserving the balance of power in Europe; it had followed the rather unexpected bequest of Carlos III. The aim of France had been shown at the second treaty for the partition of Spain, signed at the Hague, on the 25th of March, 1700. France was the leading power of Europe, and had succeeded Spain in this pre-eminence; the union of the two, together with Flanders, Naples and Sicily, and the comparatively recent acquisitions of France in the seventeenth century, would enable France to dictate to Europe, divide, conquer, annex and redistribute at will: and such was the French desire. But

England had lately been prominent under William III. in the war of the Grand Alliance, that ended at the peace of Ryswick, 11th September, 1697; and Marlborough and Prince Eugene, together with the naval commanders of England, checked French ambition. England held her own under the Treaty of Utrecht, May, 1713.

The Spanish war of 1717 to 1721, ending with the Treaty of Madrid, seems to have been both needless and barren of result. The war of Prince Eugene against the Ottomans from 1715 to 1718 was a grand success. The second Spanish war of 1726, ending with the treaty of Seville, 9th November, 1729, was ineffective. The war of the Polish succession from 1733 to 1735 was profitable to France and Spain. An Ottoman war in 1737 to 1739 ended in serious Imperial losses under the Peace of Belgrad, undoing the results of the former war. The war of the Austrian succession, 1740 to 1748, ending with the peace of Aachen, answered the aims of Maria Theresa, and was highly profitable to French annexation; England was this time a loser with regard to her colonial conquests.

The Eight Years' War, or Prussian Seven Years' War, from 1755 to the peace of Fontainebleau, 10th February, 1763, gave Silesia and Glatz to Prussia, and made her a strong power in Europe; while the colonies of England were extended and strengthened in America, and her Asiatic possessions were freed from the danger of obnoxious rivalry for some time. The Russo-Ottoman war of 1768 to 1774 ended favourably to Russia. A short war, that of the Bavarian succession, occupied Germany and Prussia in 1778-79. The revolt of the English colonies in America was directed against taxation, even to be applied for their defence under their own control; but there was also a strong repugnance to unjust officialism that was the moving spirit of the matter. The attempted arrangements for concessions were made too late; and official force was needlessly used. A final concord would not have been hopeless, had not Louis XVI. eagerly seized the opportunity for harming England. Spain and the Netherlands followed the French, and the unequal war of 1778 to 1782 was the result. The loss was English, the revolted colonies obtained independence, though they did not prosper for long afterwards, but Louis XVI. was eventually killed by the recoil of his own weapon, and Spain afterwards lost her colonies.

When the English were founding new settlements in Australia,

revolt had become a French institution ; a republic in 1792-93 removed a mischievous monarch, and banished an aristocracy that had long been simply courtiers, and had never interested themselves in the welfare of the people on their estates. But the wars of the republic were not less grasping than those of the monarchy, and the European coalitions held their own badly in the struggles, for the French success was chiefly due to financial and administrative improvements, and partly to improved tactics.

The period of religious wars had gone by ; and civil war was comparatively rare when countries were fully occupied in general war. The persecutions and expulsions on religious grounds were few. Some Lutherans suffered in Pohlen, some Camisards and Appellants in France, some Abrahamites in Bohemia. The Jesuits, however, reaped the whirlwind from their long series of meddlings in domestic and in state affairs ; they were expelled from most European countries. Nor was this surprising. The pious aim of the founders of the Order had been to elevate Christians above worldly matters into higher accordance with original Christianity ; afterwards this became the mere pretence under which the Order aimed at universal sway. If the Popedom had before failed in attempts to obtain universal political power over kings, princes, and rulers, through hierarchies and intimidation, it was yet possible for a monastic order to achieve it through private influence over individuals ; for monks had in past times succeeded where secular canons had failed. Persistent intrigue, with the help of knowledge gained through the confessional and of the control over educational training, had given them immense power. Such power was unnecessary for purely religious purposes ; it was political, and hence had either to be crushed or to be admitted as a dominant principle. The former was chosen, and Jesuit power was abolished in the only way then possible, through expulsion.

Plague and famine were less destructive than in former times ; a few countries suffered greatly on isolated occasions, specially Sweden, Bohemia, Pohlen and Russia ; but the loss of life due to earthquakes was remarkably large.

RECORD OF PROGRESS AND EVENTS

1700 TO 1799.

PERIOD OF ENGLISH COLONISATION.

1700. **Sweden**—The war of 1698 against Russia, Denmark, and Pohlen, for self-preservation from partition continues. In Esthonia, at Pernau and Narva in 1700. In Courland, at the Dwina, and at Mittau in 1701. In Pohlen and Lithuania, at Clissau, Warsaw, and Cracow, in 1702. At Pultansk and at Thorn in 1703. At Warsaw, and at Narva, and in Ingria in 1704. At Dorpat, Narva and S. Petersburg, in 1705, concluding with the Treaty of Warsaw, 19 November, 1705, affecting Pohlen only.

1700. **Great Britain**—Newton completes his demonstrations in acoustics. Mining speculation is now carried on by companies. Rise of bubble speculation, and a mania for stockjobbing, which continues till 1719. Auctions are re-introduced.

1700. **Netherlands**—New style of dating is adopted, by cutting off the last eleven days of February.

1701. **Great Britain**—Newton uses a thermometer of oil. *See* 1610. Richard Mead (b. 1678) writes works on the Plague and on poisons.

1701. **Spain**—The war of the Spanish succession begins, against France, Spain and Flanders, and Bavaria and Portugal. B. of Carpi, and B. of Chiara.

1702. **Great Britain**—War declared 4 May. The Vigo fleet is taken 12 October. War lasts till 1713.

1703. **Great Britain**—Halley first proposes tide-charts.

1703. **Italy**—Victor Amadeo II. of Savoy joins in the war against France and Spain; and Portugal declares war 16 May.

1704. **Great Britain**—The French fleet relinquishes the dominion of the sea, and the French and Bavarian armies are driven beyond the Rhine.

1705. **Great Britain**—Halley predicts the return of the comet of 1682 in 1758 or 1759, declaring it Apian's comet of 1531, and Kepler's comet of 1607, all of which were retrograde in motion.

1705. **Italy**—Tosti (b. 1658, d. 1741), writes on the use and abuse of chinchona and antipyretics.

1706. **Russia**—Subjugation of Kamtchatka.

1707. **Great Britain**—Separation of saline matters from mineral water through complete evaporation first effected as a process by Gregory.

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1707. **France**—De Forbin defeats an English fleet off the Lizard on 9 October.

1709. **Great Britain**—Rise of periodical magazine literature, 'The Tatler,' 'The Spectator,' &c. An Act against unfair prices, imposing fines on those that overcharge for books.

1709. **Germany**—Bottcher, a persecuted alchemist, discovers the art of making white porcelain; the factory at Meissen is afterwards established under him by Augustus II.

1710. **Sweden**—The plague or sweating sickness appears at Stockholm and Koppenhagen. The Swedish wars against Russia, Denmark and Prussia continue till 1720, ending with the Peace of Stockholm with Prussia, and Peace of Friederiksburg with Denmark, 8 June, 1720, and Peace of Nystadt, 30 August, 1721.

1711. **Great Britain**—A provincial army from Virginia and New England proceeds to attack Canada, but the fleet is wrecked at the mouth of the S. Lawrence. An excise duty on soap begins, and lasts for 142 years; it is supposed that the habits of the masses were permanently affected by this.

1711. **Netherlands**—Printing from stereotype plates is invented at Leyden before this year.

1712. **France**—The Jesuit d'Entrecolles describes the Chinese mode of making porcelain. A charter is granted to Louisiana.

1712. **Switzerland**—Peace of Aarau, ending the third religious war. The Romish party surrenders power.

1713. **Great Britain**—Treaty of Utrecht, 11 April. Peace with France, 5 May; and with Spain, 13 July. Acquisition of Gibraltar, Minorca, Nova Scotia, Newfoundland, and Hudson Bay by treaty. Savoy makes peace 13 August, 1713. Germany under Treaty of Baden, 7 September, 1714; with the Netherlands, 26 June, 1714; with Portugal, 6 February, 1715. The British army is disbanded. Assiento contract with Spain.

1713. **France**—Edict against Protestants.

1714. **Italy**—Bartolomeo Cristofori, a Paduan, develops the pianoforte at Florence.

1715. **Great Britain**—The elder Pretender lands near Aberdeen, 22 December, and the rebellion is suppressed after the B. of Preston, and battle of Dumblane, 13 November, 1716. Disarmament of Highland clans. Brook Taylor (b. 1685, d. 1731), publishes his 'Perspective,' and his 'Method of Increment of Direct and Inverse Functions,' which included Taylor's 'Theorem,' and was the basis of Lagrange's 'Theory of Analytic Functions.' See 1766.

1715. **France**—The regency for Louis XV. begins, and the depravity of the French Court is extreme; lettres de cachet are on sale in the hands of vicious women. Death of Perignon (b. 1640), who had perfected viticulture and wine-making in Champagne.

1716. **Great Britain**—Halley suggests the mode of obtaining the solar distance through transits of Venus.

1716. **France**—Formation of Law's general bank under edict of 2 May. Law's system was based on discounting a huge future

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commercial monopoly, and the future increased value of large territories ; it was sound, but contingent on a French development of colonisation and commerce that never took place.

1717. **France**—Louisiana is assigned to the Compagnie d'Occident, of Law's Mississippi scheme. Sebastien Vaillant, a local botanist (b. 1669, d. 1722), proposes a new botanical system to supersede that of Tournefort.

1717. **Germany**—Schroeder develops the pianoforte. *See* 1714.

1718. **Great Britain**—Hadley makes some improvements in the telescope of Gregory. *See* 1662. Spain declares war in December, 1718, against England and the Quadruple Alliance ; this war lasts till the Treaty of Madrid, 13 June, 1721.

1718. **France**—Law's bank becomes the royal bank. Councils are now suppressed, and are replaced by Secretaries of State. Plot of Cellamare and Alberoni.

1719. **Great Britain**—Sir Thomas Lombe introduces an improved silk-throwing machine at Derby, of supposed Piedmontese origin.

1719. **France**—Concessions are made to the University of Paris. Paper money is issued to the value of thrice all the cash in the kingdom.

1720. **Great Britain**—Year of the South Sea Bubble Scheme. Private companies speculate in insurance.

1720. **France**—Great mortality from plague at Marseilles. Collapse of the Mississippi Bubble Scheme, which had doubled the National Debt.

1720. **Italy**—Formation of the kingdom of Sardinia under Victor Amadeo of Savoy.

1721. **Great Britain**—Inoculation is adopted in experiments, perhaps introduced from Stambul.

1722. **Great Britain**—Kelp from the Orkneys is now used in glass-making at Newcastle : hitherto the kelp-burning was on the Yorkshire coast. Before that, barilla had been imported from Spain, but the process was Egyptian, and had been adopted by the Spanish Moors. The soda ash from kelp-burning is used in crown and bottle glass ; also by linen-bleachers and soap-boilers.

1722. **Russia**—Czar Peter of Muscovy takes the title of Emperor of all the Russias.

1723. **Great Britain**—Desaguliers attempts a systematic ventilation of the Houses of Parliament.

1724. **Great Britain**—Beginning of the later period of canal making, with the Topsham Canal, Exeter. Abandonment of the patent for Wood's halfpence, and expulsion of Wood, following the publication of the Dampier letters about the issue of £108 000 in halfpence.

1724. **Pohlen**—Barbarous outrages on Lutherans. Tribunal of Warsaw ; the Lutherans attack the Jesuits at Thorn.

1724. **Germany**—Fahrenheit proposes his thermometric scale. Fahrenheit (b. Danzig 1686, d. 1740) had invented an areometer,

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for discovering the heaviness of liquids. His mercurial thermometer scaled from zero at the freezing point of muriate ammonia to 212 at the boiling point of water, and was the earliest of the three scales.

1724. **France**—Opening of the Congress of Cambrai. Persecution of Huguenots.

1725. **Great Britain**—Stereotype plates are used by Ged at Edinburgh. *See* 1711.

1726. **France**—Boulduc separates saline matter from mineral water with alcohol. *See* 1707. A militia is established. An aurora borealis lasts for six hours in France.

1726. **Italy**—An earthquake at Palermo on 1 September kills about four thousand persons.

1727. **Great Britain**—Bradley discovers the aberration of the stars. Death of Newton. Experiments in inoculation are made on prisoners. Accession of George II. *See* 1721.

1728. **Denmark**—Some new settlements are made in Greenland.

1728. **Germany**—Death of Christian Thomasius (b. Leipzig 1655, d. Halle), who had introduced the new system of teaching in German instead of in Latin, between 1688 and 1725. Probably the old system had delayed progress in Germany for centuries.

1728. **Portugal**—Diamonds are found in Brazil, and are afterwards largely exported.

1729. **Great Britain**—Hall and Chester Moore invent achromatic telescopes. Hellfire clubs are suppressed by Order in Council. Bribery at elections is first forbidden. James Hamilton, earl of Abercorn, writes on attraction and magnetism.

1730. **Great Britain**—Cotton is spun by machinery near Litchfield. The troubles of Ireland are explained by Swift. Sir John Taylor, the oculist, begins his professional travels over Europe.

1730. **Prussia**—Imprisonment of Prince Karl Friedrich and of Von Katte at Kuestrin.

1730. **France**—Reaumur describes the dipping process of transforming iron into steel. He also discovers a mode of softening iron, and new modes of making porcelain. The Picardy Canal is begun. A balloon is made in France.

1731. **France**—Renaud Reaumur (b. La Rochelle 1683, d. 1757) proposes his thermometric scale, of 80 parts from the freezing to the boiling point of water. He also proposed a scientific botanic classification.

1731. **Great Britain**—Hadley's quadrant is invented at or before this time; but Godfrey of Philadelphia had also made an improved quadrant, rather like it.

1732. **Great Britain**—Death of John Gay (b. 1688), the poet and dramatist, who originated ballad opera in England.

1732. **Germany**—Emigration of Protestants from Salzburg.

1732. **Spain**—Campaign in Algiers and Morocco; Oran and other places are occupied.

1732. **Italy**—An earthquake in the kingdom of Naples kills 1940 and wounds 1455 persons on 29 November.

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1733. **Great Britain**—Bradley explains atmospheric refraction and terrestrial excentricity. *See* 1727.

1733. **Pohlen**—Further persecution of Lutherans, who are also forbidden to emigrate. Russia places Frederic Augustus III. on the throne; the war of the Polish Succession follows. France, allied with Spain and Sardinia, goes to war against Germany and Prussia, &c., to put Stanislaus on the throne of Pohlen. This war ends in 1735 by the Treaty of Vienna, under which France obtains Lothringen, and Don Carlos, Infante of Spain, obtains Naples and Sicily.

1734. **Great Britain**—Stockjobbing is now forbidden. New York is fortified against the Redskins.

1734. **Germany**—Separation of the Markland, or territory of the military frontier, from Slavonia.

1734. **Spain**—Pereira, a Spanish Jew, first introduces finger-talk, and teaches deaf mutes in 1734 to 1745; he afterwards also wrote on the ventilation of ships; b. 1715, d. 1780.

1734. **Italy**—After this date, Targioni-Tozzetti, physician at Pisa (b. 1712, d. 1783), propagates vaccination in Italy; he also promoted the drainage of marshes, and the prevention of floods from the Arno, and wrote on endemic fever.

1735. **Sweden**—Karl Linnee, the naturalist, publishes his 'Systema Naturæ,' and follows it by other works till 1751. His system was well suited to zoology alone, but his knowledge in mineralogy and botany was valuable.

1735. **The Two Sicilies**—The kingdom of the Two Sicilies is formed under Don Carlos, with an agreement that this new kingdom shall never be united to Spain. Don Carlos cedes the Duchy of Parma, Piacenza and Guastalla to Austria.

1736. **Great Britain**—Petitions are made about the condition of the lower classes, stating that gin drinking is the chief curse of the country. The Witchcraft Act is repealed. Death of John Mortimer, who wrote several works on husbandry.

1736. **Germany**—Ludwig writes his work on marine plants; he travelled in Africa and wrote many works on botany, medicine, and surgery; b. 1709, d. 1798.

1736. **France**—Geodetical expeditions of Lacondamine, Bouguer, and others, to measure a meridional arc in Peru; and of Lamennais and Maupertuis to measure an arc of the arctic circle. Joseph Jussieu is one of them, and investigates Peruvian and American flora for thirty-five years.

1737. **Italy**—Death of Micheli, botanist of Italy and Germany, who collected botanical information from other countries through correspondence; b. 1679.

1737. **Great Britain**—Thomas Simpson (b. 1710, d. 1761) writes on fluxions, on probabilities, and on summation of series; he also gives new formulæ for computing logarithms of sines in his trigonometry. His fluxions were published in 1737.

1738. **Sweden**—Rise of the Hat and Cap factions; the latter

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favor alliance with Russia, but the Hat party becomes powerful in 1741.

1738. **Great Britain**—Rolling mills are used for tinned plates. *See* 1626. John Kay invents the fly-shuttle for weaving. Wyatt and Paul's spinning machine with rollers is patented. *See* 1730. The Gin Act, passed in 1737, comes into effect. Theatres are now under the control of the Lord Chamberlain. Death of William Molyneux (b. 1689), who wrote on dioptrics, and made some improvements in telescopes.

1738. **Germany**—Swab uses the blowpipe in analysing metals.

1738. **Italy**—Cassini and Maraldi determine the velocity of sound by a series of experiments. Death of Albertini (b. 1662), who invented auscultation; afterwards developed by Auenbrugger, the inventor of the stethoscope, Laennec and others. *See* 1792.

1738. **Russia**—Invasion of the Krim Khanate. Peace is made with the Porte on 18 September, 1739, and the Russian conquests are restored. But the fortress of Azov is dismantled.

1739. **Great Britain**—Clayton demonstrates by experiment the use of coal-gas as an illuminant. War is declared against Spain, 19 October, 1739. Letters of marque are issued, but they had been adopted before in 1295 and 1417. Grog is introduced in the Navy. This war continues till the Peace of Dresden, 26 December, 1745.

1740. **Germany**—War of the Austrian Succession; Maria Theresa is heiress under the Pragmatic sanction, but Karl Albert of Bavaria claims the throne, and is supported by France and Spain, also by Prussia and Saxony. Carlos III. remains neutral. The works of Hoffmann, the chemist and physician (b. 1660, d. 1742), are published.

1740. **France**—Clairault (b. 1713, d. 1765) deduces the figure of the earth from hydrostatic laws; he also writes on capillarity and physical phenomena.

1740. **Italy**—Prosper Lambertini becomes Pope as Benedict IV.; an enlightened and wise man, who introduced many institutions for the welfare of the people. The geologist Moro proposes the theory of submarine eruptions, adopted by King.

1741. **Great Britain**—Hales makes improvements in ventilation. *See* 1723. Commerce with Persia is now opened through Russia.

1741. **Italy**—Venice pays an indemnity to the Porte as a war compensation. About this time Raimondo, prince of S. Severo, makes many inventions, a perpetual light, a machine for raising rain-water, and a mode of making sea-water drinkable without using alkali. Connected with the fine arts, he re-discovered the ancient mode of glass-painting; and invented cleiodrica, a mode of copying pictures on any material; a light mode of encaustic painting; and a mode of fixing coloured pastel pictures. Some of his inventions dated 1737 to 1741; he died in 1771.

1742. **Great Britain**—The chemical analysis of water now

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becomes a recognised science. Benjamin Robins writes on the principles of artillery, also on the optics of Smith, and the mechanics of Euler, and made improved instruments for Greenwich ; b. 1707, d. 1751.

1742. **Italy**—Zendrini, a hydraulic engineer, introduces the general use of the calculus among professional and scientific men in Italy.

1742. **Russia**—Revolt of the army, and deposition of Ivan VI. Elizabeth becomes Czarina.

1743. **Great Britain**—War against Spain 21 July, after an alliance with Prussia, 18 November, 1742. Alliance with Russia, 11 December, 1743.

1743. **Italy**—Ruggieri makes the modern improvements in fireworks ; the old fireworks, rockets, &c., were a very ancient Indian invention. Others were due to Buontalenti, 1536 to 1608, called Bernard of the Catherine wheel.

1743. **Russia**—Johann G. Gmelin, after travelling for ten years in Siberia, publishes his work on Siberian flora, and his travels. Again in 1747, a second work.

1744. **Great Britain**—France (allied with Prussia under the Union of Frankfurt) declares war against Great Britain and the Empire, 31 March, 1744. The war against Spain continues. This war ends with the Peace of Aachen, April to October, 1748, under which Great Britain restores all her conquests in the Antilles, in America and in India.

1745. **Great Britain**—Rebellion under the Young Pretender, Charles Edward, beginning with the Battle of Prestonpans, 21 September, 1745, and ending with the Battle of Culloden, 16 April, 1746. The carpet industry of Kidderminster begins ; perhaps with the help of some workmen from Tournay.

1746. **France**—Madame de Pompadour begins to control the government.

1747. **Great Britain**—Potato-spirit is now distilled. Watson transmits an electric shock across the Thames. Beginning of indigo culture in Carolina under encouragement with premiums. (There had been an indigenous indigo in Mejiqne and in Hayti before the Spaniards arrived.)

1747. **Germany**—Margraaf discovers sugar in beet root and in other plants.

1748—**Great Britain**—Invention of the carding machine patented by Paul.

1748. **France**—The Peace of Aachen confirms the retention of Artois, Cambresis, and parts of Hainault and Luxemburg ; the rest of the Flemish Netherlands is restored to Germany.

1748. **Switzerland**—Death of John Bernoulli, b. 1667 ; developer of the calculus in variable exponential and rational fractions ; he had taught Euler ; and first determined correctly the expansion of elastic fluids ; and taught the daily renewal of bodies through loss and substitution from nutrition.

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1749. **Germany**—The chisel-bit is introduced in the mines of the Harz by Hungarian miners.

1749. **Italy**—Papini, fl. 1749 to 1762, under the pseudonym Epoandro Napoli, writes on electricity, and on the tidal effect of solar evaporation; also on a mode of determining a meridian.

1750. **Sweden**—John Waller introduces agronomic chemistry in Sweden; he writes on the chemistry of druggist's mixtures, on the origin of nitre, alkalis, mineralogy, physics, &c.; b. 1709, d. 1780 c.

1750. **Great Britain**—Discovery of the process of making cast-steel at Sheffield, applied in 1770. First English manufacture of porcelain at Derby. *See* 1712 and 1709. Jonas Hanway reintroduces umbrellas in London; he is mobbed and persecuted. Abolition of 17 000 geneva-shops. Very severe earthquakes near London February and June. Close of the Assiento contract.

1750. **Netherlands**—Death of Schultens (b. 1686), the Orientalist, who helped much to restore the study of Arabic, Syriac, and Oriental languages. The Louvain-Malines Canal is finished.

1750. **France**—Expedition of Lacaille to the Cape of Good Hope to observe the southern stars.

1750. **Italy**—Fagnani (b. 1682, d. 1766) solves the problem of determining elliptic and parabolic arcs having algebraic differences; he also determines the properties and quadrature of the lemniscate.

1750. **Portugal**—The ministry of Pombal begins.

1750. **Ottoman Empire**—Russian intrigues with the Greeks begin; and eventually end in rebellion.

1751. **Great Britain**—Persons are now legally murdered on charges of witchcraft, if they can be inveigled into any confession; though the Witchcraft Act was repealed in 1736.

1751. **Prussia**—Emancipation of domain serfs.

1751. **Germany**—Tobias Mayer (b. 1723, d. 1762) about this time publishes his Catalogue of 998 Zodiacal stars, and his valuable Lunar Tables; he also proposes a mode of calculating eclipses.

1751. **France**—Establishment of an *Ecole Militaire* for gentlemen-cadets; apparently the first institution of that sort in Europe.

1751. **Spain**—Treaty with Portugal about territorial limits in South America.

1752. **Sweden**—Adoption of New style of dating.

1752. **Great Britain**—Improved porcelain is made at Chelsea, afterwards also elsewhere. *See* 1750. The New style of dating is introduced, the 3rd September becomes 14th September. It had been adopted in 1700 in the Netherlands, and in the Protestant states of Germany. It had also long before been adopted in Roman Catholic countries. *See* 1582. New style was originally proposed by Louis Litio, a physician, and adopted by Gregory XIII.; but from being ordered in a Papal Bull was opposed for a long time.

1752. **France**—The difficulties between the French and English in India are made subject to settlement by the respective govern-

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ments in Europe. Clairault proposes a lunar theory based on his solution of the problem of three bodies.

1752. **Ottoman Empire**—Severe earthquake at Stambul and at Edreneh, 29 July, causing loss of life.

1753. **France**—The French destroy a British settlement on the Great Miami in Ohio, and begin a series of encroachments. The former encroachments from Canada were always in Newfoundland, Cape Breton Island, and Nova Scotia.

1753. **Italy**—Venice enters into a treaty with the pirates of the Berber coast. Giovanni B. Beccaria (b. 1716) writes his first two volumes on Natural and Artificial Electricity; his others appeared in 1771. He was the first discoverer of a lunar volcano, and of the double refraction of rock crystal.

1754. **France**—The French attack some English ships, also some English settlements in Pennsylvania; a French detachment is defeated by Washington, a lieutenant of militia. Treaty of Puduchari; agreement of the French and English to abstain from military operations in the lands of native princes.

1754. **Spain**—The Canal de Campos, first of the later Spanish canals, is begun.

1755. **Great Britain**—Beginning of the Eight Years' War, against France, Austria, Russia, and Sweden, the alliance aiming at the partition of Prussia, and confirming the treaty of 1 May, 1757. Alliance with Prussia. This war lasts till the Peace of Fontainebleau and Hubertsburg, 10 and 15 February, 1763.

1755. **France**—Le Monnier publishes his 'Reduced New Zodiac,' &c.; he had adopted the methods of Flamsteed, and wrote many valuable works on astronomy and instruments.

1755. **Portugal**—A great earthquake on 1 November kills about 40 000 persons at Lisbon, and does damage at Cadiz, Seville, Xeres, and at many other places; its range of effect was from Iceland to Morocco, and to the Antilles.

1756. **Sweden**—Eight noblemen are put to death for an attempt to restore absolute monarchy; this was however eventually restored in 1772.

1756. **Great Britain**—William Cullen (b. 1712) proposes his new medical theories based on nerve treatment; he wrote on physiology, nosology, materia medica, &c.

1756. **France**—About this time Lomont (b. 1716, d. 1782) invents machines for thrashing, watering; also for triturating tobacco.

1757. **Great Britain**—Alum is discovered in Ireland.

1757. **France**—The mode of studying history through detached chronological records for various countries was proposed by Lenglet Dufresnoy, who died this year.

1757. **Switzerland**—Albert von Haller publishes his Human Physiology; he was also a botanist; his works are 150 in number.

1758. **Great Britain**—The threshing machine is invented at Dumblane, in Perthshire. Thread and gauze manufacture begins at Paisley.

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1758. **Germany**—Euler makes experiments in acoustics. *See* 1700. Cronstedt makes demonstrations in mineral research with the help of the blowpipe. *See* 1788.

1758. **France**—Bernard de Jussieu, local botanist, proposes a new classification, developed by his nephew Laurent, in 1789.

1758. **Italy**—Death of the enlightened Pope Benedict XIV. Pope Clement XIII. supports the Jesuits. Ruggero Boscovich (b. Ragusa, 1711, d. 1787), who introduced Newtonian science in Italy, afterwards in France in 1773, applies the gravitation theory to molecular motion; he also applies the calculus to problems in spherical trigonometry. He invented a mikrometer and a solar problem solved on the basis of the motion of the sun spots.

1759. **Great Britain**—Volunteer or fencible cavalry is first raised in Argyleshire.

1759. **France**—Clairaut first calculates tolerably correctly the return of Halley's long-period comet; period 76-78 years; his error being only 31 days; Halley's prediction of 1705 is verified.

1759. **Italy**—Lagrange makes experiments in acoustics. *See* 1700. After this time Toaldo, physicist of Padua, makes the first lightning conductor in Venetia; he also wrote on the influence of the stars on terrestrial meteorology; b. 1719, d. 1798. But Benjamin Franklin (b. Boston, 1706, d. 1790) was the presumed inventor of the lightning conductor.

1759. **Portugal**—Expulsion of the Jesuits; who are probably implicated in the plots of Aveiro.

1760. **Europe**—The commercial neutrality of the Baltic Sea is now arranged by Russia, Sweden, and Denmark; but the Sound-dues remain for another century.

1760. **Sweden**—Tamping with wedges is introduced by Thunberg.

1760. **Great Britain**—Robert Kay invents the drop-box for the operations of weaving.

1760. **France**—Tiphanie de la Roche explains the principles of photography; they were known to Leonardo da Vinci, and the invention was probably Italian. *See* 1741.

1761. **Great Britain**—The improved pottery of Wedgewood is made at Newcastle-under-Lyme. Opening of the Bridgewater Canal of Brindley, and beginning of a great extension of inland navigation. *See* 1724.

1761. **Netherlands**—Death of the physicist Musckenbroeck, inventor of the pyrometer, and early writer about heat on sound principles.

1761. **France**—A school of veterinary pathology and surgery is established at Lyons.

1761. **Spain**—Alliance with France under Family Pact of the Bourbons at Versailles, 15 August.

1761. **Italy**—Morgani (b. 1682, d. 1771) publishes his work on the causes of disease, and the seats of diseases as shown by anatomy; a science begun by Bonnet of Geneva.

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1762. **Great Britain**—War against Spain, 4 January. First Act for the uniform general paving of London streets; hitherto each householder had paved with any material in front of his own house.

1762. **Spain**—Acquisition of Louisiana, formerly French territory, but latterly owned by a company. *See* 1712, 1717. Invasion of Portugal.

1762. **Italy**—Liberation of the serfs in Savoy. Death of Vitaliano Donati, naturalist and botanist, who had explored many regions in Europe, Asia and Africa; b. Padua, 1717.

1762. **Russia**—Epinus discovers the electrical properties of tourmaline; he had also written a very scientific theory of electricity and magnetism.

1763. **Prussia**—End of the Seven Years' War, maintained with only one ally against Europe; the existence of Prussia was saved, and the defence has hardly been equalled in history.

1763. **Great Britain**—James Hargreaves invents the spinning jenny, which is used at Blackburn, and is patented in 1770. At the Peace of Fontainebleau, 10 February, acquisition of Canada, Florida, part of Louisiana, and some of the Antilles. Minorca is restored to England.

1764. **Great Britain**—Harrison makes improved chronometers. *See* 1662, 1663.

1764. **Pohlen**—A Diet under Russian control elects Stanislas king; the connection with Saxony is now severed.

1764. **France**—Suppression of the Jesuits by edict, after the death of Madame de Pompadour. Bougainville forms a settlement in the Falkland Islands, 17 March. Lalande, who had made many observations for lunar and for solar parallax, publishes his *Treatise on Astronomy*.

1765. **Great Britain**—Treaty of Allahabad, and acquisition of the fief of Bengal, Bahar and Orissa, for an annual tribute of 26 lakhs of rupees. Audh is also a province tributary to Bahar.

1766. **Denmark**—The gradual abolition of serfdom is begun by King Christian VII.

1766. **Germany**—Expulsion of the Jesuits from Bohemia.

1766. **Italy**—About this time Giuseppe Lagrange invents the Calculus of Variations, which he applied to vibrating cords, lunar librations, and periodic variations of great axes of the planetary system. He liberated analysis from geometrical construction, and adopted general methods; b. 1736, d. 1813. *See* 1715.

1767. **Great Britain**—First issue of the Nautical Almanac, proposed by Maskelyne. Lewis discovers the modes of alkalimetry, and applies them. The taxation of imports into American colonies begins the series of difficulties that cause revolt, and the disaffection of most of the provinces. Priestley writes on electricity, sight, light and color; he afterwards discovered vegetable respiration, and made chemical discoveries. About this time Ramsden invented a mikrometer better than that of Bouguer; he also made

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some improvements in the barometer, pyrometer, and the electric machine.

1767. **Pohlen**—The toleration of Protestants begins from 2 May.

1767. **Switzerland**—M. Reaumur adopts the theory and principles of Fothergill about suspended animation, and resuscitates several apparently dead persons.

1767. **Spain**—Expulsion of the Jesuits, 2 April. The edict applies also to American colonies.

1768. **Great Britain**—Hammond introduces lace weaving by frame, and invents a stocking loom. Chronology is reformed, and many errors are eliminated by John Jackson, the chronologer and metaphysician; b. Lensey, 1686, d. 1768. *See* 1769 and 1756.

1768. **Pohlen**—The Romish party seizes the fort of Bar in Podolia; the Confederation of Bar extends locally in other towns, becomes general, and causes anarchy.

1768. **France**—Discoveries of De Bougainville in the Pacific Ocean. Corsica is acquired from Genoa by the Treaty of Compiègne, 5 August. Quesnay publishes his work on Physiocracy of the human being; he had already written on animal economy. Sonnerat, the naturalist, begins his series of travels in Southern Asia, Madagascar, and the Sunda Islands.

1768. **Italy**—Expulsion of the Jesuits from the kingdom of the Two Sicilies, and from Parma. Death of Giuseppe A. Alberto (b. Bologna, 1705), one of the earliest writers of books, expressly on civil engineering practice.

1769. **Great Britain**—Halley's mode of determining the solar distance is now applied, through observation of the transit of Venus, the first well-observed transit since 1639. *See* 1719. James Watt invents his condenser, and patents a condensing steam engine. Arkwright introduces perpetual carding, and patents the water frame, which also embodies old inventions. Discoveries of Lieut. Cooke in the Pacific Ocean.

1769. **Germany**—Johann Bode discovers the first of the very short period comets, whose return he predicted. His planetary law is a development of Kepler's law.

1769. **France**—The management of the King and of the government by Madame du Barri now begins. After this date, Germain Pourier (b. 1724, d. 1803) reforms chronology and eliminates errors, much as already done by John Jackson. *See* 1768. The same thing was afterwards done in Italy by Rampoldi (b. 1761, d. 1836). The chronology of European nations was generally very defective.

1769. **Russia**—First passage of Russian war-ships from the Black Sea into the Mediterranean.

1770. **Sweden**—Carl Thunberg, the exploring botanist and entomologist, begins his travels in Japan, the Cape of Good Hope, Ceylon, &c., which ended 1798 c.

1770. **Great Britain**—Cast-steel is made by Huntsman at

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Sheffield. *See* 1750. He melts blistered steel, and rolls the resulting ingots into bars, obtaining close and uniform grain. Lieutenant Cook declares possession of the East Australian coast from C. York to C. Howe.

1770. **Netherlands**—A Netherlands ship in a storm in the Eastern Seas is saved by pouring oil on the waves.

1770. **France**—Messier discovers Lexell's comet; a periodicity was computed for it, but it never was seen again. Bourgelat (b. 1712, d. 1799) writes many works on veterinary anatomy and treatment. François Rozier (b. 1734, d. 1793), botanist and agronomist, writes on wine-making; he afterwards, in 1784, wrote on ancient and modern balloons, and on agriculture and veterinary practice.

1770. **Europe**—Severe plague in Bohemia, Pohlen, Russia, also at Stambul; in Bohemia there are 168 000 deaths from plague and famine.

1770. **Ottoman Empire**—A Russian expedition, intended to assist the Greeks to revolt, is defeated.

1770. **Italy**—Spallanzani (b. 1720, d. 1799), the naturalist and mineralogist, made observations on infusoria, wrote on artificial fecundation and reproduction, and made experiments on digestion.

1771. **Great Britain**—Calico-weaving, an Indian industry, is established in Lancashire. *See* 1676. Discoveries in the South Seas by Solander, Banks, and Cook.

1771. **France**—The Parliament is replaced by six Superior Courts.

1771. **Russia**—Peter Pallas (b. Berlin, 1741, d. 1811) travels in Russia, Krim, and Siberia, to collect matter for his works on Russian flora and insects.

1772. **Sweden**—A revised constitution is formed under Gustavus III., who becomes absolute monarch.

1772. **Great Britain**—Priestley discovers the mode of impregnating common water with fixed air. First emancipation of negro slaves on their arrival in England. Resistance is made in New England to the tea-tax of threepence per pound. The seat of Indian government is moved from Murshidabad to Calcutta; and Warren Hastings becomes Governor of Bengal.

1772. **Pohlen**—Intervention of Russia, Prussia and Austria to control the anarchy caused by the Confederation of Bar, and the Dissidents. *See* 1768. First Partition, 5 August.

1772. **France**—About this time Oberkampf (b. Anspach, 1738) introduces in France English machinery for spinning and weaving at Jouy and Essonc.

1772. **Russia**—Severe plague at Moscow, causing 130 000 deaths.

1773. **Denmark**—Cession of Oldenburg and Delmenhorst to Russia in exchange for Holstein-Gottorp and part of Sleswik, thus completing Holstein as a Danish province.

1773. **Great Britain**—The manufacture of cast plate-glass is

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established in Lancashire. Opium cultivation in India, and the supply of opium to China, become monopolies of the East India Company. Trade-controllers are sent out to India as judges; they found a peculative bureaucracy of extreme pretensions. Death of George, Lord Lyttelton, poet and historian (b. 1709), who had introduced or invented English landscape gardening.

1773. **Italy**—Pope Clement XIV. (Ganganelli) expels the Jesuits from Rome, 16 August.

1774. **Great Britain**—The systematic resuscitation of the apparently dead is now undertaken by the Royal Humane Society. *See* 1767. Compton unites the principles of Arkwright and of Hargreaves in his mule spinning frame. Dismissal of Franklin's petition; and passing of the Boston Port Bill.

1774. **Germany**—Werner (b. 1750, d. 1817) publishes his work on mineralogy, in which a new classification is adopted.

1774. **France**—Restoration of the former Parliament of Paris by Louis XVI., 12 June. *See* 1771.

1774. **Switzerland**—Le Sage establishes telegraphic communication at Geneva. *See* 1793.

1774. **Russia**—Peace of Kutshuk Kainarji, 21 July. Free navigation of the Black Sea is acquired. Final acquisition of Azov, and some places on the Euxine. The Krim Khanate becomes temporarily independent of the Porte.

1775. **Sweden**—Carl Scheele begins his series of chemical discoveries (*See* list), beginning with the re-discovery of oxygen, known to Mayow. He died in 1786.

1775. **Great Britain**—The poplin industry begins in Ireland; it had long existed in England, but was of French origin, perhaps originally from Avignon. The Philadelphia Congress of Deputies rejects a proposal of self-taxation; and some rebels surprise two forts. Troops are sent under Burgoyne, Howe, and Clinton, to subdue the revolt. About this time William Nicholson discovers the chemical action of the galvanic pile, applies the areometer to finding the heaviness of solids, and makes several mechanical and hydraulic inventions.

1775. **France**—Abolition of forced labor by *corvée*, under a decree issued by Turgot. Perronet, engineer of the Seine-Saône Canal de Bourgogne, makes bridges more horizontal than before, with longer approaches, and proposed modes of bridging spans of 300 to 450 feet. Rome de l'Isle writes his work on Crystallography.

1775. **Germany**—Revolt of Bohemian peasants. Serfdom or slavery still existed in Bohemia, and was not abolished till 1781 or 1785.

1775. **Spain**—War begins against Portugal, and ends at the Peace of Pardo or S. Ildefonso, 31 March, 1778.

1775. **Italy**—Carlo Amoretti (b. 1741, d. 1816 c.) publishes his twenty-seven volumes on science and art; and afterwards his selection from it on 'Animal Electrometry and Rhabdomancy.'

1776. **Great Britain**—The Crown has no remaining military

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positions in the revolted provinces. The Congress of Philadelphia declares independence, 4 July. Adam Smith publishes his work on the 'Character and Causes of National Wealth.' Edward Jenner notices the immunity of milkmaids from Asiatic small-pox at Berkeley; and in 1798 proposes vaccination, a very ancient Indian remedy.

1776. **France**—Montalembert (b. 1714, d. 1800) proposes the casemated system of fortification, and opposes the modes of De Marchi, reproduced by De Vauban.

1776. **Italy**—Giuseppe Canini invents secondary magnetic needles; but he obtained his knowledge from a Mantuan Jew, Lampadio Cales. He afterwards wrote on the animal electricity of Mesmer. *See* 1778.

1777. **Germany**—Wenzel's work, 'On the Chemical Affinities of Bodies,' is published. This forms the basis of the theory of definite chemical proportion.

1777. **France**—About this time Coulomb (b. 1736) adopts the torsion balance for determining the laws of electric attraction and repulsion.

1777. **Italy**—Volta, who invented his perpetual electrophone in 1775, now invents the lamp and pistol of inflammable gas; and later his eudiometer for ascertaining the amounts of oxygen and of nitrogen present in air.

1778. **Great Britain**—Melville invents the carronade, which is made at the Carron Iron Works. The revolted colonies obtain a French alliance, 6 February, and afterwards a Spanish alliance, but the Netherlands do not begin war until 20 December, 1780. This American war ends with the acknowledgment of the independence of the United States, 30 November, 1782; the Treaty of Versailles, January, 1783; and evacuation of New York, 23 November, 1783.

1778. **Germany**—War of the Bavarian Succession, in which Saxony joins Austria against Prussia; it ends with the Peace of Teschen, 13 May, 1779, and the cession of part of Bavaria to Austria.

1778. **France**—Frederic A. Mesmer of Marburg (b. 1744, d. 1815) opens a school of 400 students at Paris, and receives a salary from the State for teaching curative magnetism. His experience had been mentioned at Vienna in 1773; his planetary influence theory seems to have been separate. Parmentier, a pharmacist and analyser of foods, introduces more extended cultivation of the potato; he also improves flour-mills and bread-making.

1779. **Great Britain**—Iron is used in bridge-building by Pritchard at the Coalbrook Dale, Severn. Tobacco is grown in Ireland under a Permissive Act, 19 George III.

1779. **Italy**—Fabris invents a table for harmonizing instruments without tuning together, also a music-recording gravi-cembalo; he could also write at full as quick as speech.

1780. **Spain**—The scientific explorations of Don Felix d' Azara

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(b. Aragon, 1746), in America begin this year; he went to define the Spanish and Portuguese frontier. His works in four volumes were translated into French by Valckenaer in 1809.

1780. **Great Britain**—About this time the study of Sanskrit literature is introduced by Charles Wilkins; b. Frome, 1749, d. 1839.

1780. **France**—Argand, a Swiss resident in Paris, adopts an improved mode of distillation. *See* 1152.

1780. **Switzerland**—Breguet (b. 1747, d. 1823) makes perpetual watches. He also made many repetition movements in watches. Afterwards he made sympathetic pendulums, an astronomical regular reading to hundredths of a second, and visible in the telescope tube, and a sensitive metallic thermometer.

1780. **Italy**—Fortis makes experiments on subterranean electricity, also on intermittent springs, volcanos, and antiseptic waters; b. 1741, d. 1803.

1780. **Russia**—The objection to the Search of neutral vessels in war time is adopted by Russia and Sweden. Prussia joins the Armed Neutrality Convention on 8 May, 1781.

1781. **Great Britain**—Macarthur, a naval secretary, proposes a new code of flag-signalling. *See* 1605 and 1420. Emerson takes a patent for an improved process of making brass. Muslin manufacture, an Indian industry, is now much extended in England. *See* 1690. William Herschel accidentally discovers Uranus with the help of a newly invented telescope. John Brown (b. Berwick, 1735) founds the modern system of medicine on his inductive method; afterwards universally adopted throughout Europe.

1781. **Italy**—Vacca-Verlinghieri writes on hygiene and on transfusion of blood; b. 1732, d. 1812.

1782. **Great Britain**—Acknowledgment of the independence of the United States, 30 November, 1782.

1782. **Germany**—Ecclesiastical jurisdiction over the press is abolished; other civil reforms are effected.

1782. **France**—The Marquis de Jouffroi works a modified Newcomen engine on a boat 42 metres long at Lyons; this is the earliest attempt at steam navigation.

1782. **Italy**—The Inquisition is abolished in the kingdom of the Two Sicilies. Volta now invents his electric condenser; but his electromotor or Voltaic Pile was invented afterwards, between 1782 and 1793, or later. Giuseppe, Count of Saluzzo, invents a silk spinning machine, and new modes of dyeing.

1783. **Great Britain**—H. Johnson invents logographic printing.

1783. **France**—De Luc and Saussure invent hygrometers. The brothers Montgolfier make some balloon experiments. *See* 1780 and 1670. Thouvenel writes on hydrosCOPY and the dowsing rod, an old Indian art also well known in parts of England; he is a scientist who wrote on electricity and magnetism, and was inspector of mineral waters.

1783. **Russia**—Krim is annexed, after a virtual independence of nine years. Thirty thousand Krim Tartars are massacred, and

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the Khan abdicates. Death of L. Euler, physicist and astronomer, and mathematician, discoverer of laws of fluid motion, developer of solutions in mechanics with the calculus, and of circular functions, writer on dioptrics, and inventor of achromatic telescopes.

1783. **Italy**—Scuderi (b. 1733, d. 1819) shows that contagious diseases may be entirely extinguished.

1784. **Great Britain**—Symington of Falkirk invents the road-locomotive. Cartwright invents the steam-loom. Cavendish decomposes water. *See* 1742. The usurious practices of Anglo-Indian officials are partly suppressed; but the officials still invest in land, which is sold and transferred through courts by officials of the same class at forced prices.

1784. **Italy**—Some monasteries are suppressed in the kingdom of the Two Sicilies, baronial service is also abolished. Balloon ascents at Naples by Lunardi. *See* 1783.

1785. **Great Britain**—Cort brings forward his process of producing bar-iron by puddling and rolling. *See* 1730.

1785. **Prussia**—The Furstenbund, or Germanic confederation of princes, begins at Berlin, 23 July.

1785. **France**—Nicol Blanchard, the inventor of the parachute, crosses the Channel with Doctor Jeffries from Dover to Calais.

1785. **Germany**—Vassalage is abolished in Hungary, and serfdom is abolished in Bohemia about this time by Josef II.

1785. **Spain**—Formation of the Philippine Company.

1785. **Italy**—Gattoni of Como makes experiments with very long wires to foretell changes of weather. Mascheroni applies the calculus in the equilibrium of vaulting; he also makes some graphic solutions of problems.

1786. **Denmark**—The liberation of the serfs by Christian VII. is now completed, that was begun in 1766.

1786. **Great Britain**—An annual payment of one million pounds is now begun for the reduction of the National Debt.

1786. **Netherlands**—A disagreement between the States and the Stadtholder leads to civil war, but the Prussians intervene and restore the Stadtholder.

1786. **Switzerland**—De Saussure publishes his botanical works in four volumes (1779, 1786 and 1796): he rectified errors of Buffon in natural history, and made many Alpine discoveries in botany and mineralogy; he also invented some meteorological instruments; b. 1740, d. 1799.

1787. **Sweden**—War against Russia, also against Denmark; ending at the Peace of Werelock, 14 August, 1790.

1787. **Great Britain**—Agitation about the slave trade. Right-boy outrages in Ireland, and Peep-o'-day boys.

1787. **France**—Aimé Argand, a Swiss resident at Paris, patents a lamp with a circular burner, and a metallic chimney to burn without smoke. He is robbed of his monopoly by the Parisians at the Revolution. *See* 1780. Convocation of notables, 22 February, and Parliamentary contest with the king. The king attempts to

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raise a very large loan, 19 November. Laplace, who had in 1773 determined the invariability of the mean planetary distances, now discovers the cause of the secular equation of the moon: he also applied in detail the principles of Newton, and comprised these in an improved form in his '*Mecanique Celeste*,' published in 1799. Lavoisier proposes an improved chemical notation.

1787. **Italy**—Testa, the physiologic pathologist, writes on vitality and reaction periods. Mascagni the anatomist (b. 1755, d. 1815) prepares his life-size anatomical plates (published at Pisa, 1823-32); also his '*Anatomy for Artists*' (published at Florence, 1816), and makes many anatomical discoveries: he also improved sheep-breeding, and artificial pastures, and extended potato cultivation.

1788. **Great Britain**—Merino sheep are brought from Spain; probably an English breed of sheep that was exported in 1464 or 1467. First settlement in Australia. Impeachment of Warren Hastings, reducing him to poverty in 1795 after his acquittal.

1788. **France**—Re-discovery of animal magnetism. Second convocation of notables on 6 November; the nobles join the Third Estate in opposing the wishes of the king. Etienne Lenoir makes a parabolic reflector, and discovers the concentration of light due to reducing the diameter at the centre.

1788. **Italy**—The kingdom of the Two Sicilies is freed from claims of suzerainty by the Pope.

1788. **Ottoman Empire**—Beginning of the Suliot rebellion, which lasts intermittently for fourteen years.

1789. **Great Britain**—Symington puts an experimental steam-boat on the Clyde Canal. *See* 1782. Henry Greathead, boat-builder at South Shields, builds the first lifeboat, which is launched in 1790. William Edwards, a mason, builds a bridge over the Taaf at Pontypridd, which has a segmental arch of 147 feet span.

1789. **Germany**—Revolt of Brabant, and declaration of independence, 22 October; suppressed in 1790. Kratzenstein makes an automaton that pronounces the vowel sounds; he also used electricity curatively, and wrote on steam.

1789. **Pohlen**—Declaration of independence, and separation from Russia.

1789. **France**—Borda makes a catoptric parabolic reflector light for the Dieppe lighthouse. Concessions by the nobles, 23 May. Convocation of the Third Estate, or National Assembly, 17 June. Concessions by the king, 28 June. Revolution at Paris, 14 July. The National Assembly sits in October and November. Issue of assignats, 21 December.

1789. **Netherlands**—Death of Camper (b. 1722), who discovered air in the hollow bones of birds.

1789. **Italy**—Scarpa, the operative surgeon, introduces improved operations: he also writes neurologic tables and works on anatomy.

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1790. **Great Britain**—Immigration of French royalists. A nail-making machine is invented by French at Wimborne, in Staffordshire. Water-power is applied to looms instead of animal and manual labor. *See* 1784.

1790. **France**—Gathering of Gardes Nationales, 14 July. Suppression of religious houses. Abolition of all titles, both earned and those by descent. The National Assembly is dissolved on 30 September. Legislative Assembly meets 7 October

1790. **Italy**—Fabbroni, a scientist holding some post at Florence, establishes a magnetic observatory, the first in Italy after this year. He lived 1752 to 1822, and had invented a mode of forming borax.

1791. **Great Britain**—Canada receives a representative constitution. Sand tamping is adopted by Le Plat.

1791. **Germany**—Johann Blumenbach founds the science of craniology; he publishes his collected illustrations of skulls of various races.

1791. **Pohlen**—Independent Pohlen forms a new constitution, 8 May, and forms an alliance with Prussia. Prussia holds the first congress of Reichenbach to oppose Russian aggression.

1791. **France**—The king is kept under guard in April, and escapes 21 June, but is brought back. Rising in La Vendée, 30 June. New constitution proclaimed, 18 August. New issue of assignats amounting in all to 1400 million francs.

1791. **Italy**—Petrônio Caldani (b. 1735) writes on the logarithms of negative numbers.

1792. **Great Britain**—Second period of English bubble speculation. This is now based on Canal shares; thousands are ruined by the market-rigging. A veterinary college is established at London. *See* 1761. A self-righting lifeboat is suggested by James Bremner of Orkney. *See* 1789. Revival of minstrelsy by Welsh bards at Primrose Hill, London, 22 September. An English patent describes the use of compressed oil-gas, which was afterwards adopted in Prussia in 1871. Bell invents a mode of communicating with a wrecked ship. Death of Smeaton (b. 1724), engineer of the Eddystone lighthouse, improver of the pneumatic engine, the hygrometer, pyrometer, and other instruments.

1792. **Germany**—Coalition of Francis I. with Prussia for intervention in France. Invasion of Champagne; retreat of the Duke of Brunswick with the allied Austrians, and 20 000 French émigrés. Death of Leopold Auenbrugger (b. Graetz, 1722), the inventor of the stethoscope, afterwards used by Laennec and Corvisart. *See* 1738.

1792. **France**—Baron Larrey raises a corps of brancardiers, and introduces an ambulance volante. A Republic is proclaimed by the National Convention, 21 September. War is declared against Hungary and Bohemia. Annexation of Savoy and Nice for twenty-two years. The Palatinate is ravaged. The Republican

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era is 1 January, 1792, of 11th nivose de l'an I. Basel is annexed in 1793.

1792. **Spain**—Female influence is ascendant at Court, and makes Manuel de Godoy Minister of State.

1792. **Italy**—About this time Tiberio Cavallo (b. 1749, d. 1809) first employs hydrogen for inflating balloons; he also invented a mikrometer and electrometer, and an instrument termed a director of electricity.

1793. **Great Britain**—Bligh introduces the bread-fruit tree from Tahiti into the British Antilles. Charles Earl of Stanhope (b. 1753, d. 1816) about this time invents a printing press and improvements in type-founding, stereography and clissography.

1793. **Pohlen**—Second partition, under which Russia acquires Posen, Thorn, &c.

1793. **Germany**—Revolt of the Rhine Provinces.

1793. **France**—Chappe invents an electric telegraph. *See* 1774. Louis XIV. is beheaded, 21 January. Reign of terror by the democrats. War in La Vendée. War is declared against England and the Netherlands, 1 February, and against Spain, 6 March. Russia joins the coalition against France, 25 March; and the Two Sicilies on 3 September. War of the First Coalition. Revolt of Corsica, and at Lyons, Bordeaux and Marseilles. Massacre of 6000 French families, December.

1793. **Italy**—Alessandro Volta announces the contact theory of galvanism of two heterogeneous bodies. Toffoli makes a machine for making lenses, and invents an odometer, a pocket mikroscope, and several astronomical instruments (b. 1755, d. 1834), but he ceases to invent after this year.

1794. **Sweden**—Convention of Copenhagen with Denmark, 27 March.

1794. **France**—Corsica annexes itself to Great Britain. Recognition by the United States of America in August.

1794. **Italy**—Death of Giovanni F. Cigna (b. 1734), who introduced medical electricity in Italy, perhaps at Turin.

1795. **Denmark**—Tribunals of conciliation are established to prevent needless law processes.

1795. **Pohlen**—Final partition. Prussia acquires parts of Great Pohlen and of Little Pohlen.

1795. **Germany**—Humboldt proposes enlarged chambers for mine-charges.

1795. **France**—Treaty of Basel with the Netherlands, 20 May. Peace is made with Prussia, Spain, Hesse and Tuscany. Belgium is united to France, October. The Directoire is nominated, 1 November.

1796. **Great Britain**—Bramah invents a water-tight collar, and utilises the hydraulic press of Cavalieri. *See* 1650. Treaty of Colombo, 15 February. Evacuation of Corsica. French invasion at Bantry Bay, December. The hydraulic press had been invented by Cavalieri, inventor of fluxions (b. Milan, 1598, d. 1647); but

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brought forward by Pascal about 1650 (b. 1623, d. 1662) ; but was virtually useless for practical work.

1796. **Germany**—It is supposed that about this time the chemist and mineralogist, Friedrich Accum (b. 1769) and Rodolph Ackerman (b. 1764) invented gas-illumination, and introduced it in England, but it was known to Clayton in 1739. The latter also invented springcushions for carriages, and waterproofing of woollen and cotton cloths. He was a printer, and adopted lithography from Senefelder. *See* 1799, also 1798.

1796. **France**—Italian campaign of Buonaparte. Campaign in Germany. Treaties with Prussia, Baden and Spain ; forced alliance with Bavaria.

1797. **Great Britain**—Rise of volunteer soldiery to defend ports and forts in the absence of the regular troops. A patriotic fund is established of contributions for war and defence.

1797. **France**—Etienne Montgolfier makes improvements in the hydraulic ram, an invention of presumed Italian origin. Campaign in Lombardy and Venice. Treaty of Campo Formio, 24 September ; acquisition of vast territories.

1798. **Great Britain**—Murdoch erects the first gas-works at Soho Foundry, Birmingham, but he had already used gas at Redruth, in Cornwall. His principles were adopted by Winsor in 1803. Second coalition with Russia and Austria against France, and war till 1802. Peace of Amiens.

1798. **France**—Swiss campaign, and Egyptian campaign. Pope Pius VI. is removed, 15 February. Thilorier proposed a military descent on England in balloons. He was a physicist, wrote on aerolites, and invented the mode of ascending rivers in rafts ; he also proposed a system of omnibus transport on a network of roads.

1799. **France**—Neapolitan campaign ; Syrian campaign. Successes of Suwarrov in four battles. German campaign against Archduke Karl. French envoys are sent to Tippu. Consular constitution formed ; Buonaparte is made First Consul in December.

1799. **Bohemia**—About this time Aloysius Senefelder (b. Prague, 1771) invents lithography with the aim of copying music. He travels over Europe to introduce his invention. Music-copying by stencil was, however, an English invention about 100 years old.

1799. **Switzerland**—De Saussure, the botanist and mineralogist, who died this year, had invented many meteorological instruments and appliances. *See* 1783.

DISCOVERY IN SPECIAL BRANCHES.

Archaic Discoveries.

1720. The ancient mound and stone structures of Abury, Wilts, are studied by Stukeley.

1738. The Roman theatre of Heiculaneum is found by Alcubier.

1748. The buried Roman town, Pompeii, is discovered accidentally.

1755. Excavations at Pompeii discover the whole town.

1760. Velleia, near Piacenza, is discovered.

1771. The Zendavesta is discovered and translated by Anquetil Duperron.

1781 c. The Codex Carolinus, and the Codex Argenteus of Ulphilas in Mæso Gothic are found; they were published in 1781-83 and in 1805.

Naturalistic Notes.

1730. Reputed entire extinction of the wolf in Ireland (*See* 1680 and 1281).

1742. Steller discovers the *Rhytina Stelleri*, a sea-cow, 28 to 35 feet long.

1772. Pallas discovers a frozen *Rhinoceros tichorhinus*, or woolly two-horned rhinoceros, 11½ feet long, at Willu in Siberia.

1780-80. The giant eagle, *Harpagon*, of New Zealand, becomes extinct, perhaps from the scarcity of its prey, the *Moa*.

1799. Discovery of a frozen *Elephas primigenius*, or mammoth curved-tusked elephant, 16 feet long, at the mouth of the Lena R.

Chemical Separations, &c.

The metals before known were only ten. the following were separated in this century —

1733. Arsenic (Biandt).

1733. Cobalt (Biandt).

1741. Platinum (Wood).

1751. Nickel (Cronstedt).

1774. Manganese (Scheele and Gahn).

1781. Tungsten (De Chujart).

1782. Molybdenum (Hjelm and Scheele).

1782. Tellurium (Mueller).

1789. Uranium (Klaproth).

1789. Zirconium (Klaproth).

1791. Titanium (Klaproth and Gregor).

1794. Yttrium (Gadolin).

1797. Chromium (Vauquelin).

Other Substances.

1707. Saline matter separated from mineral water through complete evaporation (Gregory).

1710 c. Oxygen first discovered (Mayow).

1725-1801. Soda extracted from sea-salt (Darcet).

1728. Saline matter separated from mineral water through adding alcohol (Boulduc).

1730. Steel made by dipping iron (Reaumur).

1781-1808. Combustible paper used in Venice arsenal. Metal founding without carbon or flux; crystallisation of pure sulphuric acid; discovery of the affinity of nickel for silver (Carburis).

1781 c. Sea-water is first made drinkable (Hales).

Discovery in Special Branches

1736. Soda and potash are now recognized as distinct substances (Duhamel).

1737-1816. The disinfection of air with chlorine (Guyton).

1738 c. Blow-pipe analysis proposed (Swab).

1739 c. Illumination with gas (Clayton).

1741 c. Sea-water made drinkable without using alkali (Prince S. Severo).

1742. Nitric ether is prepared by Navier. (It was known to Kunchel in 1681, and before.)

1747. Potash is extracted from sorrel (Margraaf).

1747. Sugar is separated from beet (Margraaf).

1753-1825. The chemical action of the Galvanic Pile (Nicholson).

1755-1826. The extraction of grape sugar, and the investigation of hydrates and sulphates (Proust).

1758. Blow-pipe analysis adopted (Cronstedt).

1766. Hydrogen gas is explained (Cavendish).

1767. Method of alkalimetry (Lewis).

1767-80. Nitrous acid gas discovered (Priestley).

1770. Tartaric acid separated (Scheele).

1772. Azotic gas (nitrogen) (Rutherford and Priestley).

1772. Hydrochloric acid gas (Priestley).

1774. Oxygen gas separated (Priestley).

1774. Chlorine, or dephlogisticated, or oxygenated muriatic acid (Scheele).

1774. Protoxide of barium is discovered (Scheele).

1775-86. Lactic acid and gallic acid, hydro-cyanic acid, arsenicated hydrogen, and hydrate of sulphur (Scheele).

1778. Carbonic acid discovered, also latent heat (Black).

1782. Artificial ice made chemically (Walker).

1784. Water is completely analysed (Cavendish).

1795. Bleaching is done with chlorine (Berthollet).

1796 c. Illumination with gas (Accum).

Applications of Steam.

[See original discoveries in 1663, 1695, 1698.]

1769. The condenser, and condensing steam engine; also the cylinder cover, articulated parallel motion, and heated steam (Watt).

1782. First experimental steam-boat, 42 metres long, with a Newcomen engine fixed on it by the Marquis de Jouffroi at Lyons.

1783. Steam flour-mill at London Bridge.

1784. Steam loom is invented (Cartwright).

1784. Road locomotive (Symington).

1789. Steam-boat, experimental (Symington).

Electricity and Magnetism.

1729. Writings of James Hamilton, Earl of Abercorn, on electricity and magnetism.

1741-1822. Amoretti wrote on animal electricity and rhabdomancy; also Carradori.

1743-1822. Haüy wrote on electricity.

1747. Transmission of an electric shock across the Thames, by Watson.

1749-82. Papini writes on electricity.

1753-71. Writings of Giovanni Beccaria on natural and artificial electricity.

1762. Writings of Epinus on electricity and magnetism; discovery of the electrical properties of tourmaline by him.

1767. Writings of Priestley on electricity.

1773. Frederic Mesmer employs curative animal magnetism

Discovery in Special Branches

at Vienna (the re-invention of Gre-torex)

1773 and 1794. Cigna introduced medical electricity in Italy.

1774. Le Sage uses electric communication at Geneva.

1775. The chemical action of the Galvanic Pile is discovered by Nicholson.

1775. Volta invents his Perpetual Electrophora.

1776. Secondary magnetic needles are found by Giuseppe Canini.

1777. Coulomb attempts to measure electric attraction and repulsion with the torsion balance.

1778. Mesmeric school of students opened at Paris, which continues for five or six years.

1780. Observations on subterranean electricity by Fortis.

1782. Volta invents the electric condenser.

1782 and 1793. The electro-motor or Voltaic Pile is invented by Volta.

1783. Thouvenel writes on magnetism and electricity.

1785. Climatic observations with long wires by Gattoni at Como.

1789. Kratzenstein uses curative electricity.

Between 1790 and 1822. Fabbroni establishes a magnetic observatory, the first in Italy.

1790 c. Toaldo uses a lightning conductor in Venetia (invention of Franklin).

1792. Cavallo invents the electrometer and the director of the current.

1793. Claude Chappe employs telegraphic communication in France (*See* 1774).

1793. Volta announces his contact theory.

Before 1800. Perkins used curative magnetism.

EXPLORATION AND SETTLEMENT.

African.

Gambia.

1724. Exploration of Stubbs.
1791. Exploration of Houghton.
1794. Exploration of Watt and Winterbottom.

1795-97. First expedition of Mungo Park from the mouth of the Gambia to the Felapi, Jolofi, Fula, and Mandingo tribes; across the kingdoms of Walli, Wulli, Bondo, Cajanga, Kassa, Kaarta, and Bam-baa to the Niger. Thence eastward down the Niger to Silla. He returned westward, going across all the Mandingo country, and the desert of Jallonka to the river Gambia and to Pissarua; whence he returned to England.

Senegal.

1758. Keppel takes Fort Louis, and the forts on the Island of Goree.
1763. The English restore Goree.
1779. The French retake S. Louis.
1790. The English retake Goree.

Sierra Leone, &c.

1750. British African Company the Fifth formed.
1772. Exploration of Norris, who reaches Abomey.
1787. First settlement of negroes from London.
1789. Burning of Sierra Leone.
1790. Second settlement of negroes from Nova Scotia and founding of Free Town.
1794. Plundered by the French ships.

Cape of Good Hope.

1795. The English take Cape Town.
1797. Exploration of Barrow in Kaffirland.

Madagascar, &c.

1712. Cerne (Mauritius) abandoned by Hollanders.
1715 and 1721. French settlement.
1774. The French send Ben-yowski to rule their settlement.
1786. He is killed by the French settlers.

Asia and Indian Ocean.

North Asia.

1706. Kamtschatka subdued by the Russians.
1713. Russian discovery of some of the Kurile Islands.
1728. Vitus Behring, a Dane in the Russian service, discovers Behring's Strait.
1741. Some of the Aleutian Islands discovered by Behring.
1778. Cook visits the Aleutian Islands.
1778. Complete Russian discovery of the islands of the Kurile archipelago.
1783. Juan dos Remedios enters the Corea as a missionary from Peking.
1785. Russian settlement on the Aleutian Islands.
1788. Cook surveys Behring's Strait.
1797. Captain Broughton visits the Corea.

Exploration and Settlement

Arabia.

1761-66. Travels of Carsten Niebuhr in Arabia.

Tibet.

1714. Visit of Desideri to Kashm and Tibet.

1796. Exploration of Hardwicke in Tibet.

India.

1700. The English acquire Chataumatti, Govindpur, and Calcutta.

1766. Massacre at Calcutta of English.

1767. Recovery of Calcutta, acquisition of the 24 parganahs.

1760. Bardwan, Midnapur, and Chittagong acquired.

1764-65. Occupation of Audh.

1765. Acquisition of the revenues of Bengal, Bahár, and Orissa.

1771. The Emperor forms a Maratha alliance against the English.

1772. Resistance to the Marathas, and refusal of allegiance and tribute to the Emperor.

1772. Independence of British India.

1785. Second Maratha demand.

Southern India.

1754. Treaty of Madras with the French.

1759. The English acquire Masulipatam.

1761-63. English occupation of Pudukhari.

1766. Acquisition of the Northern Sarkars.

1788. Acquisition of Gantúr.

1792. Acquisition of Baramahal, Dindigul, and Malabar.

1799. Acquisition of Kanára, Koimbatúr, Wynaad, and the Nilgiri.

Ceylon.

1763. English refusal to intervene in Ceylon.

1765. British occupation of Ceylon.

1766. Treaty of Colombo, and annexation.

Burma.

1709. Visit of Hamilton to Burma.

1794. Burmese attacks on India.

Anam.

1787. French settlement in the delta of the Mekhong.

Sunda Islands.

1707. Destruction of an English factory in Borneo.

1772. An English factory is started at Passar.

1776. The Hollanders establish a factory at Pontianak.

1780. The Hollanders acquire much of the west coast of Borneo.

1786. The Hollanders destroy Succadana, and afterwards acquire much of the south coast.

1742. Visit of Anson to the Ladrone Islands.

1762-63. English occupation of Manila.

1763. English occupation of Balambangan.

1775. Destruction of Balambangan by pirates.

1783. Visit of the 'Antelope' to the Pelew Islands.

1790-98. The English ships visit the Pelew Islands.

1796. English occupation of some settlements of Hollanders in the Molluccas.

Australian and Pacific Islands.

1700. Explorations of Dampier at Dampier Island, and discovery of New Britain.

1705. The Hollanders explore the north-west coast of Australia.

1727. Exploration of 'the Zeewyk' about Australia.

1767. Carteret discovers New Ireland Island.

1769-70. Explorations of Cook round New Zealand, and round Papua.

1770. Cook lands at Botany Bay.



Exploration and Settlement

1772. Explorations about Tasmania by Marion.

1772. Kerguelin discovers Desolation Island.

1773. Furneaux discover Adventure Bay, and visits Tasmania.

1774. Visit of Cook to Australia, New Zealand, the New Hebrides, and New Caledonia.

1777. Third voyage of Cook to Adventure Bay.

1788. Philip founds the settlement of Sydney and makes the roads, &c. by forced labor.

1788. Explorations of La Pérouse.

1789. Bligh discovers Banks Island.

1791. Discovers Vancouver.

1792. Expedition of d'Entrecasteaux to South Australia and Tasmania.

1792. Visit of MacClure to MacClure Bay, Papua.

1798. Bass and Flinders discover Port Dalrymple, also Bass' Strait.

1799. Flinders discovers Moreton Bay, Queensland, and sails round Tasmania.

1722. Visit of Roggewein to Easter Island.

1768. Discovery of Pitcairn's Island.

1768. Visit of Bougainville to the Solomon Islands.

1769. Visit of de Surville to New Zealand and to the Solomon Islands.

1774. Visit of Cook to Easter Island.

1788. Visit of Shortland to the Solomon Islands.

1790. Settlement at Pitcairn's Island.

1748. Anson visits the Hawaii Islands.

1767. Wallis visits the Tahiti Islands.

1768. Bougainville visits the New Hebrides.

1769. Cook visits the Tahiti Islands.

1773. Cook visits the Tonga Islands.

1774. Cook visits the New Hebrides.

1776. Discovery of some of the Mendana Islands by Cook.

1777. Second visit of Cook to Tahiti Islands.

1778. Cook visits the Hawaii Islands.

1794. Brown discovers Honolulu.

North America.

Labrador, Greenland, Oregon.

1718. Re-settlement of Greenland by Danes.

1721. Norwegian settlement at Godthaab, in Greenland.

1778. Cook visits Queen Charlotte's Island.

1787. Moravian settlements in Labrador.

1787. The North-west Company obtains rights in the Hudson Bay territory.

1787. Dixon visits Queen Charlotte's Island.

1792. Vancouver visits Quadra (Vancouver Island).

1792. Oregon re-discovered and declared British by Broughton and Baker.

1799. Travels of Alexander Mackenzie about the Mackenzie and Peace rivers, the Granite Mountains, the Cascade Canal, Menzies Point, and King Island.

Canada.

1702-13. War against the English in Maine and Acadie closed by Treaty of Utrecht.

1711. British invading fleet is wrecked.

1712. French settlement on Ile Royale.

1746. Shirley's projected invasion fails.

1755-60. War against the English.

Exploration and Settlement

1760. English occupation of Canada.

1763. Treaty of Paris. Cession of Canada.

1775-76. Civil war and invasion.

1791. Representative constitution formed.

Acadie (part of), French.

1702-18. War of the Spanish Succession.

1710. The English occupy Port Royal.

1713. Treaty of Utrecht; cession of French Acadie. It is re-annexed to Nova Scotia.

Nova Scotia, Newfoundland, &c.

British settlements since 1621, comprising part of Acadie (protected by the New England colonists).

1712. The French form a settlement in C Bieton Island (re-named Ile Royale) by virtue of the Treaty of S. Germain (1632).

1713. Annexation of the French part of Acadie, afterwards re-named New Brunswick.

1713. Newfoundland is acknowledged British.

1720. The French build Fort Louisbourg, Ile Royale.

1742-48. War of the Austrian succession against France.

1745. First capture of Louisbourg by the English; also first capture of Ile S. Jean (Prince Edward Island).

1748. Ile Royale, also Ile S. Jean (Prince Edward Island) are occupied. Treaty of Aachen; restoration of Louisbourg.

1749. Halifax settlement of Nova Scotia.

1752. The French destroy an English settlement on the Great Miami, Ohio.

1758. Second English occupation of Louisbourg, and complete occupation of all Acadie.

1760. English occupation of all Canada.

1760. The Cherokees destroy the English settlements in Tennessee.

1762. The French take S. John's, Newfoundland, and occupy it for three months.

1762. The English recover S. John's, Newfoundland

1763. English acquisitions under Treaty of Paris.

1763. English acquisition of Vermont, French Ohio, Michigan (including Iowa and Minnesota), Illinois, Indiana, part of the Mississippi, Alabama, Mobile, French Canada, &c.

1763-64. Settlements near Fort Cumberland and in New Brunswick

1768. Separation of Prince Edward Island.

1783. Acknowledgment of independence of the 13 United States.

1785. Separation of New Brunswick.

Louisiana Territory.

1702. Bienville founds Mobile.

1708. The Spaniards attack Charleston, Carolina.

1711. A second town founded, Mobile.

1712. French charter of Louisiana territory.

1717. Law's Company obtains Louisiana, and Bienville founds New Orleans.

1762. S. Genevieve, Upper Louisiana, is founded.

Florida.

1762. Cession to Spain of Missouri, Nebraska, Kansas, Arkansas, Louisiana (State), part of Mississippi, and Alabama.

1765. The English acquire Florida in exchange for La Havana, &c.

1781. The Spaniards retake Florida and Pensacola.

New England, &c.

1702-18. Wars in Maine, &c.

1702. New Jersey becomes a

Exploration and Settlement

Crown colony and is united to New York.

1724. French settlement in Vermont.

1786. Re-separation of New Jersey.

1742-8. Wars against the French.

1752-60. French attacks and war.

1783. Acquisition of Vermont, French Ohio, Indiana, Michigan (including Iowa and Minnesota), Illinois; under Treaty of Paris.

1770-73. Tea-tax riots at Boston.

1775-83. War of independence.

1783. The States of New Hampshire, Massachusetts, Rhode Island, Connecticut, Delaware, New York, New Jersey, and Pennsylvania, become independent as United States.

Virginia and Maryland, &c.

1715. Maryland is restored to the proprietors.

1752. The French destroy an English settlement on the Great Miami, Ohio.

1752-60. French war.

1765. Riots about the Stamp Act.

1767. First visit of Europeans to Kentucky.

1775. First English settlement of Kentucky as part of Virginia.

1775-83. War of independence.

1783. Virginia and Maryland become independent, as United States.

Carolina and Georgia, &c.

1719. Revolt against proprietary government.

1729. Crown purchase, and division into North and South.

1733. Oglethorpe settlement of Georgia.

1742. The Spaniards attack Georgia.

1750. Settlements in Tennessee.

1760. The Cherokees destroy Tennessee settlements.

1763. Mobile, part of Mississippi, and Alabama are acquired by the Treaty of Paris.

1771. Revolt of North Carolina suppressed.

1775-83. War of independence.

1783. All Carolina becomes independent.

United States.

1783. Independence of 13 States, 3 Sept; the English evacuate New York, 25 Nov.

1786. Revolts in Massachusetts and New Hampshire.

1791. Admission of Vermont.

1792. Admission of Kentucky.

1794. Revolts in Pennsylvania.

1796. Admission of Tennessee.

1798. Mississippi and Alabama together become a territory of the Union.

Mexico.

1700. Entire suppression of buccaneering.

1767. Expulsion of the Jesuits.

Guatemala.

1730. British settlement in Mosquito territory.

1740. Formal possession of Mosquito territory.

Antilles and Carib Islands.

1703. The French and Spaniards destroy the British settlements in the Lucayos.

1718. English re-settlement of the Lucayos.

1759-63. English occupation of Guadalupe and Madania, and restoration.

1762-63. English occupation of Cuba, and restoration.

1778-83. French occupation of Domenica.

1782-83. Spanish occupation of the Lucayos.

1794. Second English occupation of Guadalupe.

1797. English occupation of Trinidad.

Exploration and Settlement

South America.

New Granada.

1718. Quito is detached from Peru and joined to New Granada.

1727. English occupation of Trinidad.

1731. Venezuela becomes a separate province.

1741. Vernon attacks Cartagena.

Guiana.

1712. The French attack Berbice.

1796. The English take Demerara, Essequibo, and Berbice.

1799. The English take Surinam.

Brazil.

1760. Expulsion of the Jesuits.

1772. Revolt of the natives and negros.

1789. Insurrection in the province Minas.

Peru.

1718. Separation of the province Quito.

1778. Separation of La Plata, Bolivia, &c.

1780. Revolt of Peruvians under Tapac Amaru.

Bolivia.

1778. Separation from Peru of the provinces La Plata, Potosi, Charcas, Chiquitos, &c.

Chile.

1722. Chronic state of war against Spain. The Chileños expel

the Spaniards from most of the country.

Paraguay.

1747. Treaty with the Abiponians.

1763. The Jesuits are established in S. Carlos and Rosario.

1765. The Abiponians attack these colonies.

1767. Expulsion of the Jesuits.

La Plata (a Province of Peru).

1723. Building of Monte Video by colonists from Buenos Ayres.

1740. Formation of a southern boundary.

1763. Attack on Buenos Ayres repulsed.

1775. La Plata becomes a separate vice-royalty, with Buenos Ayres for capital.

1778. Opening of the Rio La Plata to all nations.

Patagonia.

1766. Expedition of Wallis.

1774. Explorations of Cook.

Falkland Islands.

1764. French settlement under Bougainville.

1766. English settlement in Falkland Islands.

1767. The French cede their claims to the Spaniards.

1770-71. A Spanish occupation of the Falkland Islands now begins.

1771. Restoration by the Spaniards to the English.

NINETEENTH CENTURY

1800 TO 1885.

PERIOD OF GERMAN RESTORATION.

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NOTE.—Incomplete and specially arranged.

NINETEENTH CENTURY

1800 TO 1885.

PERIOD OF GERMAN RESTORATION.

GENERAL DEVELOPMENT.

THE progress of Europe in this century was great, and the conditions were generally favourable. If there was more peace for a longer time in this than in the preceding century, it was due to reaction against the perpetual war that had been maintained for the ambition of France from 1793 to 1815. The comparative peace of 1815 to 1854 was a novelty; that from 1856 to 1866 followed closely; another from 1871 to 1890 was broken by the Ottoman war of 1877-78, which was confined to Russia, Rumania and Bulgaria, as regards military operations in Europe. Disturbances, apart from direct war, had more effect on Europe in this century than in the last; these will be treated in the Section on political condition.

It will be noticed that the period of nearly unbroken peace, 1815 to 1854, was not that of greatest development or of most progress. Nor is it surprising, when we reflect that all the great modes of communication, ocean steamers, railways, telegraphs, and improved letter and parcel posts, had not then been extended, and that intercourse between nations has always been an important basis of extension and development. The use of steam, in its endless series of applications, had not then increased production, and set labor free for better purposes. The second half of the century had fourfold advantages over the first half, apart from the accumulations of the general stream; and though the expansion was not by any means fortuitous, the reapers were not the sowers, but only their descendants. Utilisation was yet far from speedy.

In the following brief remarks on the Development of progress and science, it must be borne in mind that these do not deal comprehensively with the whole century, and are hence on a method different from that employed in the preceding nine; similarly also in the Record of Progress. Complete information will not be available till about 1910, when a rearrangement of matter on the former plan may be possible. Even if the selected information be scanty (for a volume would not hold enough of it), the chosen parts are perhaps sufficient to serve the temporary purpose of roughly carrying the work on to about the year 1880.

The English had been the leading power in Europe: their naval supremacy, the vast extent of their colonies in the eighteenth century, and their resolute opposition to Napoleonic dictation in Europe, had given them not only prestige, but both leisure, comparative wealth, and substantial progress, while Europe was being devastated. They were a century in advance. But they were a squandering nation, if also generous. Their Chinese and Indian trade was thrown open to the world gratuitously; and they taught the world commerce, without keeping a fair share of it. Their mechanical industries, and the whole series of arts of producing machines and using them, all their applications of steam to every industry, which they had developed from the inheritance of their fathers, and were specially English, were given away. The effect of Cobden's commercial treaty with France in 1860 was to give all these things to France, and through them to the whole continent: the advantages received were French fondants, Lyons silks, wine of Champagne, and expanding crinoline skirts. A severe long commercial depression was the inevitable result to England, as soon as the full effect was produced. After this, various industries specially English, as that of making dyes, went to Germany for lack of some systematic control and encouragement. English consuls were the last to make a careful study of the wants of English commerce, and to assist their own merchants. English officials have always been unpatriotic; their supposed grandeur being based on neglecting and harming their own countrymen, and favouring foreigners. From all the above causes, the nation has found itself injured and despised. It may yet recover, but not until the old absurdities cease.

France and Germany have greatly extended their commerce, and improved their financial condition during the century,

apart from their war losses. Italy is still involved in the expenses entailed by her unification. In Europe generally finance management is on the whole settled on a stable basis ; every country can raise money, and knows the value of its credit ; financing is not monopolised by any nation or any race, and it is now recognized that usually nations can best borrow of their own people, and pay interest to them ; also that even otherwise it is better to borrow than to neglect the public weal ; for profits always cover interest.

All the sciences of former centuries have received very large developments in this, mostly with some economic bearing of a utilitarian sort. Astronomy, Botany, Physics, Zoology, Mineralogy, Mathematics were the old sciences, and some of these took great strides in this century. The modern arts were the application of steam, and of electricity, the use of powerful explosives, illuminants, and methods of preserving food. Sanitary science was also new in its great development—the effect of reducing mortality from thirty-five to sixteen per thousand afforded proof that the science was not a mere abstract collection of theories. The medical profession greatly enlarged their pharmacopeia by the admission of a huge series of American drugs, and learned the value of some of them. Pathology still remained the branch in which the French physicians excelled, while operative surgery was maintained at its highest in England. The medical system of John Brown was gradually adopted by all nations in this century ; similarly the methods of auscultation and percussion invented by Auenbrugger were employed throughout Europe. The homoeopathic treatment of chronic complaints by Hahnemann, through his employment of very small doses of strong poisons, was also new. The fuller knowledge of the nervous system obtained by Cullen, Rolando and Gall was also utilised in medical practice.

Proceeding to the consideration of the sciences severally, astronomical discovery in the first half of the century continued as in the eighteenth ; but after the discoveries of the little planets, and of Neptune, and a multitude of comets, the solar system had become thoroughly explored, and the observations of the stellar system, with its colored, variable, and multiple stars, became tedious work, bringing little knowledge. Very powerful and accurate instruments of great cost were necessary, and were only to be had in public observatories. The interest in such astronomy dwindled, the former knowledge

had become widely diffused, and the astronomers became rather computers than physicists of nature. In fact, they took the position of actuaries, and often were so practically; for, apart from pretensions, the computation of orbits was not more scientific than that of intricate probabilities of reversions, or of real present values of doubtful stock and shares. The star-gazing computers also had in many cases been attached at some time to ecclesiastical universities, and had acquired collegiate vanity and cramped notions.

But a new and very useful class of practical astronomers, who could take observations for geodetic purposes, and compute intricate matters with accuracy, had sprung up, after a gradual separation from the astronomers of the old style. Geodesy was a comparatively new science after this separation. It had been of French separation, and chiefly due to the French, who made many geodetical observations in Peru, Spain, and other parts in the eighteenth century; and it had been followed up in India by the English, in China by the Jesuits, in Russia by skilled geodesists, in Italy and in Germany and throughout Europe, chiefly in the nineteenth century. If the later geodetic operations were far more skilful and exact than the earlier, the meed of praise to the French for pioneering this branch of science should not be hence reduced. Meteorology, formerly much monopolised by theoretical astronomers, in this century became a detached branch of physics, studied and developed to an enormous extent by special meteorologists, and by geodesists and botanists. A large development of meteorologic appliances and instruments accompanied.

In naturalistic sciences, zoology and botany, the developments of the nineteenth century were effected through a greater division of labor. Naturalists confined themselves to special branches, such as ovipers, birds, fuci, grasses, &c., and treated them with more thoroughness, especially regarding physiology and acclimatisation. If the results are great, it is yet sad that governments have not sufficiently supported and encouraged such labours, for much of it has been lost for want of record. The salaried zoologist hardly exists, and salaried botanists only in places least suited for research, public gardens in their own countries; the funds for publishing their results are not forthcoming; yet the grub-hunting entomologist may save a famine, and the lives of a large population. A small reward to one single entomologist out of fifty in some rare case is not sufficient encouragement to this branch of science; such a man

would have been venerated as a prophet by an Asiatic nation, if he saved them from a famine, without saying how he did it, and declared himself an agent of the Creator. The unearthing of locusts' eggs, and the burial of locusts, was an intrinsically valuable discovery of the nineteenth century; any Egyptian Pharaoh would have made the inventor of it prime minister or grandee of his realm; no friend at court of any political party would have been necessary, for he would have said, '*Find me that man.*' In Europe, the government does not yet say, '*Find the man*'; and the civil list is everywhere quite inadequate to rewarding any such men: hardly, in fact, large enough for rewards to courtiers for personal service. Tradesmen, not kings or ministers, now control the public purse.

Chemical science in this century took the enormous development indicated in the Section devoted to that subject; and on examining the corresponding Section for the eighteenth century, in which modern chemistry was created, the forecast of a still greater and more valuable development in the twentieth century is clearly shown. Future prosperity and domestic economy seem dependent to a great degree to such future developments. If several of the greater chemical discoveries are specially English, the capabilities of the French in smaller matters of applied chemistry point to their future lead in successes of this sort, more especially as they encourage scientists more than other nations.

Geologic science of a modern order, based on an accurate knowledge of fossil fauna and flora in terrestrial deposits and formations, is a comparative novelty of the nineteenth century; hitherto it had gone little beyond mineralogy and hazardous theories. It is specially a science of English origin, to which several discoveries of large collections of fossils gave rise. The English geologists were William Smith, Buckland, Richard Owen, Andrew Ure, Henry Delabèche, Charles Lyell, Murchison, Miller, John Phillips, Hugh Strickland, and Sir John Richardson. Other nations followed in the wake. In simple mineralogy the Germans and the French did much; to the latter the science of crystallography is entirely due, unless the claims of Guglielmini, 1655 to 1710, be better than those of Hauy.

Mathematics did not take any large strides by way of comprehensive discoveries in the nineteenth century; most of that had been done before. In this century the elliptic functions of Jacobi and of Cayley, the developments of Arbogast,

Cauchy, and Abel; of Sturm, Sheepshanks, Parkinson, the dual logarithms of Byrne, were doings in the earlier part. Also there was much development in some branches, more useful than attractive. Actuarial formulæ and computations were developed largely by Gray, King, and others.

Applied mechanics was greatly extended into a comprehensive large series of useful engineering solutions of strain, strength, elasticity and deflection in new and complicated structures. In this the French took the lead; the English following them with later developments by a comparatively small number of engineers out of a numerous profession; for the fallacy, that practical design could dispense with accurate theoretic knowledge, was long retained in the island. This notion, erroneous in itself, had been partly due to the fact that the clergy, who still were allowed to teach mathematics, were incapable both of practical applications of it, and of accurate detailed calculation; they thus brought it into disrepute. A set of mathematical instructors, free from clerical and university traditions, had not yet risen in England, though they existed in Germany, France, and Italy. In France, Poisson (b. 1781, d. 1840), was the leader of the great modern development; though, before his time, others in England, Russia, and France had treated of this branch of science to a limited extent.

The development of purely scientific instruments and appliances was analogous to that of mathematics in want of absolute novelty. Yet there were many improvements and developments based on older things, also minor novelties.

Proceeding now to the various branches of physics, steam, electricity, and the older branches of light, sound, and heat, &c. Though the mechanical applications of steam to various purposes were numerous, useful, and important, as shown in the Section devoted to them, there were yet very few improvements or novelties in the mode of using the expansive power of steam itself; superheated steam was new, and little else. The coarse original use of steam in direct reciprocating movement of a piston-rod, transmitted to a wheel, remained constant; but boilers were improved, and economy of fuel was introduced. Every scrap of mechanism connected with steam was perfected to a high degree, but the mode of using steam remained as before.

In electricity, however, the conditions were just the reverse; the discoveries and inventions of this century are magnificent, while the details of use and of application are very imperfectly developed. Voltaic electricity, electro-magnetism, and magneto-

electricity, direct magnetism, dry electricity of contact, are great forces, unknown as useful power before this century; the numerous electric appliances and instruments of this century are ingenious and valuable, but the details of use in economic application still require much elaboration. Electric lights that extinguish themselves, telegraphs that do not communicate or require a clerk of three years' special experience, telephones that are nearly mute, are still things known to us. But electricity will yet have numerous new applications; its use in chemical decomposition, in metallic welding, transmission of power, and such matters, are mere foretastes of the future. The credit of the great electric discoveries of this century may be justly divided between the Italians and the English, though the former frequently ignore Faradic electricity as an independent invention.

In the older branches of physics, the subject of polarized light, brought forward by Fresnel as a new branch of science, has been more specially French, and other nations have followed and borrowed from them, but the branch of spectrum analysis has been English and German. In both heat and sound there is not much novelty in doings of this century, though the results of Fourier are valuable; but ventilation and air science is better understood than before.

The miscellaneous developments of this century will form a deferred subject.

Anatomy in almost all its branches unfortunately has fallen too much into the hands of the medical profession, but there are signs of a recovery. Perhaps in future more educated men will know something about both physiology and anatomy, and leave only pathologic physiology to the surgeon and physician, for this is more specially their province, and is comparatively modern, unpractised before the eighteenth century. The outcry in England against vivisection of animals has unfortunately impeded scientific investigation in this branch, imposing a prohibitory delay when valuable opportunities occur. Perhaps the more impulsive objectors will eventually learn that pathologic knowledge is a necessary acquirement, and that the want of operation on living animals must induce very unscientific and harmful operations on human beings in their times of need. Of course, there is a choice between inflicting pain on a frog, and on a man or woman; but those who prefer that human beings should suffer, can only expect the hatred of their fellow creatures for such preference. There is

no third course, or way of avoiding both. When this is fully known, the impediments will probably be again removed in England. In other nations objection has not been raised to pathologic physiology. In France and Switzerland the bias is strongly in favor of it, as interesting; apart from results to science.

When we consider the scientific progress of the whole century in detail, and compare it, not with that of last century, but with itself in half centuries, and relatively to the possible combined progress that the combinations of various branches of science indicate, it seems relatively small. When, after duly considering the past and present, we look forward to the future, the conclusion is forced on us that the mere existence of some nations will be dependent on the scientific achievements of their learned men. The feat of Archimedes in destroying a fleet is a petty prototype, the skill of Von Molke is one in a single branch. When Napoleon said, "*Les Prussiens ont des mitrailleuses aussi*," he showed that he had depended on his own as a novelty that would win the campaign. Combinations of many such things will be necessary to success in future. Here again the English are specially in fault, the encouragement of scientific men is not systematic; there is no annual grant for encouragement and developing crude inventions, no Department of Inventions, no public workshop for making and testing models. The inventor is treated in inverse ratio to the greatness of his discovery. Bitter experience will be necessary before the British Government will sufficiently encourage science, and support the scientist.

The study of Asiatic languages, and the resulting translations from valuable ancient scientists and historic authors, developed greatly in this century. As these translations are useful, the names of some of the translators are given :—

Antoine L. Chezy, *b.* Neuilly 1775, *d.* 1832—transl. of Sanskrit poems.

Ottmar Frank, *b.* Bamberg 1770, *d.* 1840—transl. of Sanskrit philosophical works.

Auguste des Longchamps, *b.* Paris 1805, *d.* 1840—transl. the *Manava Dharma Shashtra*, and edited the vocabulary of Amara Sinha.

Simon A. Langlois, *b.* 1788, *d.* Nogent 1854—trans. Sanskrit sacred and other works.

Colonel Todd, *f.* 1827—transl. the Prathhirai Chohan Raja of Chandra.

Ernest Meyer, *b.* Schaumburg 1813, *d.* 1866—transl. the Sakuntala, Nal, and Damayanti, and an anthology of Asiatic poetry.

Frank Hessler—transl. the surgical work of Susruta into Latin.

J. E. Colebrooke, *f.* 1817—transl. the mathematical works of Bhaskara Acharya and of Brahmagupta.

H. H. Wilson, *fl.* 1835—transl. selections from the works of Hindu dramatists.

Edward Upham, *fl.* 1833—transl. the Sinhalese Maharansi, Raja Ratnakari, and Rajavali.

Marshman, *fl.* 1806—transl. the Ramayana and Mahabharata.

Firoz Mulla bin Kans, *fl.* 1817—transl. the Dasātur into English.

J. G. L. Kosegarten, *b.* Ruegen 1792, *d.* 1860—transl. many Sanskrit, Arabic, and Persian works into Latin.

G. H. Bernstein, *b.* Kosped 1787, *d.* 1860—transl. the Hitopadesa, some Arabic poems, and an Arabic treatise on the rise of Oriental religions.

The Abbé Dubois, *fl.* 1826—transl. of the Fables of Bidpai.

J. A. E. Jaubert, *b.* Aix 1770, *d.*

1847—transl. of Idrisi's cosmographical work.

Josef Purgstall von Hammer, *b.* Graetz 1774, *d.* 1856—transl. of Arabic, Persian, and Turkish books.

Etienne M. Quatremère, *b.* 1782, *d.* 1857—transl. the works of Rashiduddin, of Ibn Kaldun, and of Makrizi. Coptic philol.

Sir Richard Burton (the Hajji)—transl. of the Alif Lela and other works.

Mitchell, *fl.* 1830—transl. the Turkish naval wars of Haji Kalfa.

H. G. Raverty, *fl.* 1862—transl. of Pakhtu poems and lyrics.

John Luther Vaughan, *fl.* 1862—philol. and transl. of Pakhtu works.

Jean A. Remusat, *b.* Paris 1788, *d.* 1832—transl. of Chinese, author of a History of Buddhism.

Education at last has taken a sensible course; scientific schools and colleges have been instituted, and begin to replace the horrible ecclesiastical curriculum of mispronounced dead languages and bad theology. Art also receives some encouragement. The higher education of grown-up persons is, however, much neglected; the man of forty should know much more, instead of less, than he did at twenty; he should also not be behind men of other nations. Libraries and circulating libraries form the mere course through which the additional modern knowledge should come; but who is to write the books? The higher the subject of a book, the fewer readers for it, hence national subsidies are necessary to provide higher books. The higher education of the relatively few is far more important than the common schooling of the masses.

Construction and building took large strides from the introduction of railways and waterworks, and from the employment of material of new and better sorts. In this the English took the lead and maintained it, for Cobden could not sell that. But the French, under a system of official civil engineers, free from financial dependence on companies and with many other advantages, followed in close rivalry. The English, however, excelled in certain branches, waterworks and sewerage of towns, and drainage utilisation. In India they carried out works of irrigation on an enormous and unprecedented scale; which usually fell into some one of the following classes:

1. Duab irrigation of tracts between two large rivers, or of a large valley of a single river. 2. Flood irrigation. 3. Deltaic irrigation. In railways, the English were pioneers, closely followed by French and Germans; but in harbours and docks the French were as efficient as the English, in navigable canals, perhaps better.

Fortification did not take any fresh development on new methods; but the tendency of the period has certainly been to depend more on field fortification, and less on permanent fortresses. Military tactics entered into new general methods; the principle of immediate attack adopted by the British troops during the Indian mutiny became the basis of the so-called German system, which similarly dispensed much with manœuvring and regular formations in close proximity to the enemy. The greater range of modern cannon and rifled fire-arms of all sorts, the high expense of maintaining large armies in the field for a long time, and the advantages of immediate and rapid movement, have also affected both strategy and tactics. In naval tactics, the advantage of using steam has added greatly to sureness and precision of movement. The use of protective armour, of torpedoes, and the electric light, and of combination of vessels of various classes, are also new factors in such matters.

Mechanical construction in this century developed on a large scale. The use of steam, of machine tools, of hydraulic power, and of electric transmission, enabled not only greater, but more numerous things to be done. The generosity of Cobden robbed England of a multitude of monopolies of this class at a single blow; but English mechanics of the higher sort are still the best in the world. They have only to maintain a few more strikes for higher wages, in order to drive to other countries the remnant of the English industries of this class.

The fine arts, poetry and the drama did not generally fall back during the numerous developments of the century. The Italian and German composers did as much and as well as hitherto. Wagner introduced a new operatic mode of continuous melody, dispensing with vocal airs; Gounod raised French music from triviality; and a few English compositions of merit belong to this century. Among other composers were Hummel, Klein, Meyer, Meyerbeer, Schubert, Schumann, Spohr, Dehn, Kreutzer, Beethoven, and Bartholdy among Germans. Bellini, Cherubini, Clementi, Donizetti, Fioravanti, Morlacchi, Paer, Rossini, and Verdi among Italians. Adam,

Auber, David, Hérold, Habeneck, Halevy, Boieldieu, Méhul, and Lafont among the French; and Balfe, Bennett, Bishop, Burney, Davy, Webbe, Wallace, Macfarren, Jackson, and Sullivan among the English, whose reputation for musical composition, though not for execution, was specially low. The shadow of Puritanism long hovered round the island as a pall, stifling all brilliancy of musical origination.

In painting, the French acquired the lead in Europe generally, though the English and Belgian landscapes were still unsurpassed, and the Italians were moderately good in many branches. The French painters of repute in the earlier half of the century were David, Decamps, Delacroix, Delaroche, Gergid, Girodet, Ingres, Isabey, Baron Gros, Fabre, and the two Vernets. Among the English were Cox, Turner, Varley, Eastlake, Wilkie, Mulready, Fielding, and Landseer. Among Italians, Camucini, Fancelli, Fendi, Migliara, Nenci, and others. There were also Cornelius, Hess, Schadow, Scheffer, and Kuegelgen.

Sculpture in this century was as good as that of the preceding. The notable sculptors were Thorwaldsen, Canova, Houdon, Gibson, Marochetti, Marchesi, Eberhardt, Westmacott, David, Tolstoi, Danneker, Bartolini, Bell, of several nations.

Poetry did not decline. The two best English poets, Coleridge and Southey, lived in this century; while Russia, Hungary, Germany, Denmark and Spain had many excellent poets; though Italian and French poetry was perhaps weak. The drama became popular in style during this century, and plays were written more to catch the public attention of the hour than to attain intrinsic excellence. As a general rule an old play was a good one; and such could not be written in modern times.

POLITICAL CONDITION.

Though Europe was comparatively peaceful throughout the century, and had generally abstained from aggressive wars of ambition and profit, the civil wars, rebellions, and outbreaks of various sorts were more numerous and harmful than ever. Not only that, they were of a new sort, liable to perpetual recurrence. The rebellions of the olden time had invariably some definite object, a matter of succession, of evident suffering or of disability, that admitted of some unmistakable remedy: even the most factious of parties in former times knew their own aims, and were willing to fight and die to establish them. The chronic discontent of European masses in the nineteenth century was based usually on brutal envy and greed; the common herd hated those they wished to plunder and rob, and occupied themselves in pressing pleas under which it might be done. The French had done it in 1793, hence it was possible also for other nations. Chartism, Socialism, Nihilism, Fenianism, adopted wide terms and loose expressions that covered much. Nor was this surprising. If real grievances could not be otherwise brought forward, and hence could only be remedied in the indefinite future, if at all, why should any be mentioned? No government has yet had the courage to establish a bureau for grievances that would give positive and direct replies to enquiries after remedy, and publish comprehensive replies on large questions. If it were done fairly, the percentage of real grievances of different sorts thus eliminated would be very small. Open investigation must be always the forerunner of public remedy; but repressive officialism, momentarily effective, must surely add fuel to the flame.

This was the condition under which every nation in Europe, even some of the more intelligent among their masses, went through a series of riots under the guidance of envious and greedy mob-leaders. Hardly had real political war ended in 1816, and the opportunity of peaceful progress arrived after twenty years of war, when rebellion became a distinctive feature of the century. In England the Habeas Corpus Act was suspended, and at Breslau, in Prussia, in 1817, there was a serious revolt. These were the two flourishing countries of

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the time. In 1818 new constitutions were given to Bavaria, Wurtemberg, and Baden, after some movement of pressure on the government; in 1819 and in 1822 there were serious insurrections in Spain. These were all countries, that had been freed of foreign invaders, whose governments had done their best for the people and had lately been successful in their doings. There were Congresses in 1819 to 1822 or 1823, in which rulers met to devise means of preventing revolt. The Greek revolution was perhaps the mere result of Ottoman oppression. Sicily and Calabria had been in an intermittent state of anarchy from 1829 to 1847; and the perpetual rioting in the kingdom of Naples may have been due to Neapolitan instability and love of rebellion; but the revolt of Belgium was a marked feature among the outbreaks of the age. Carlism in Spain was the only honest outburst of the old spirit, the maintenance of the legal succession. Saxony and Brunswick, which revolted in 1830, had to be rendered satisfied with new constitutions. Switzerland had a civil war in 1841 to 1847; Portugal had riots besides a Miguelist war.

The great outburst of all Europe in the year 1848 was an infectious one without general concerted action, but evidently due to something besides love of imitation, though it lasted in effect till 1850 in some countries. Russia was unaffected, and Spain was resting, just relieved of a Carlist war; but the rest of Europe was a pandemonium of mobs. The cause can be easily deduced, even if one ignores the accounts of those that took part in it, Hungarian and Italian exiles, whose warmth of feeling may have set aside cool judgment. Many of these countries had comparatively lately received new constitutions; and some of these constitutions must either have been insufficient in themselves, or were mere paper documents. Without going into detail, the latter may be considered proved. The series of revolutions of the 1848 period were not chiefly the riots of greedy mobs, but political revolts under unselfish patriots generally. One cannot doubt that they were not then asking for something new, but for something refused or held back. The old bone of discontent was that terms made and constitutions given were waste paper, about as valuable as the political word of Charles I. Officialism could be brutally repressive even with cabinets full of charters of liberties. Several of these revolts were caused by the deliberate falsehoods of governments and rulers, though many others of the century were not. Even if concessions

wrung by violence were not morally binding, it was yet the duty of governments to ameliorate political conditions that were evidently galling to the people and failed to maintain public security. Political rights were divine, so too political duties; neither should have been neglected.

It is remarkable that the whole series of revolutions of 1848-50 did not attain the object of greater political freedom. France formed a second republic only to fall under slavery to an emperor, who sent his opponents to Cayenne in 1852, and was likely to suppress others. Other nations did not even arrive at that extreme; their rulers came back when the people had worn out their efforts, and subdued the revolts by direct force. If England suffered less than other nations, it was on account of her free institutions and comparative absence of officialism, also because the people were generally interested in some small colonial war. The clever Louis Napoleon, who acted as special constable during the Chartist riots, understood this; and throughout his career imitated his uncle in keeping some war on hand for the good of his nation. The long period of European peace from 1815 to 1854 had been an error of a special sort; it was not suited to reckless and rebellious people. If it requires a special character to do nothing really well, a specially qualified people are necessary to live entirely at peace, without war, revolt, or disturbance. The people of most European countries have not yet transformed themselves sufficiently to be able to do it: as a rule, they are grumblers that do not know what they want from a political aspect. They have been raised to a condition far above any in Asia or Africa; every generation is collectively more prosperous than its fathers; the result of the prosperity is that they kick like overfed horses. On the other hand, the art of ruling and of government has not yet been learnt. Statecraft is not only hampered by past tradition, it is still based on compulsion, expediency, and trickery, and merely tempered with gleams of wisdom, justice and forethought.

The events of the later half of the century show that after the war of 1854, political life, national and commercial development, science and art, sprang forth with renewed vigour.

The great changes in Europe, Italian unity, Germanic supremacy, and autonomy of the Balkan States, followed war; yet none of these things were preconceived designs, deliberately carried into effect to the full. Napoleon III. freed Lombardy alone, and not for an idea; the dynastic connection with the

house of Savoy was the presumed reason, and the acquisition of Savoy and Nice the object; dynastic marriages may be made in heaven, but they are difficult to preordain on earth. The Austro-Prussian quarrel about Denmark was fortuitous; the acceptance of Prussian supremacy in Germany by the King of Bavaria may have been dependent on the weather, if the mental condition of members of the Bavarian dynasty be considered. As to the Ottoman war, not a military man in Europe could have foretold that Rumanian troops would take a fortress that had become a matter of despair to the Russian army after many attacks; a fact that gave a special turn to the results of the whole campaign. If war is occasionally inevitable, the comparative shortness of modern wars is the great blessing of the epoch; the time for recovery is longer, and things are less thrown out of gear.

Though religious wars are things of the past, also persecutions, yet Jesuits and Jews have frequently been banished from European countries; this may be considered the meed of their deeds and aims, rather than of their creeds, for benevolence is not due to human wolves.

Famines were few in this century. Cholera has made several inroads, but epidemics are now relatively less destructive than before. Clean habits, pure and wholesome food, good drainage, and better nursing, have done much to reduce mortality, even during virulent outbreaks. Everything seems to indicate that when cleanliness and hygiene become thoroughly known to the people and carried into effect, drugs and medicine will be wanted less. With pure air, good drainage, and wholesome water, life in rural districts has been much prolonged, as proved by reduced death-rate; the next step will be to improve the conditions of occupation in urban life. For these a special hygiene has yet to be devised. The diminution of needless toil, trouble, and prospective risk, the opportunities for healthy exercise, the purification of the air from innumerable causes of foulness, an economic supply of necessities, the complete utilisation of all labor of every kind through a system of forethought and ready application, are some of its basic points. All matters that produce effect on the individual, corresponding to that of plague and famine on the mass, have to be dealt with. The term "superabundant population" will become a fallacy, when the service of every one can fully contribute to useful development and progress.

RECORD OF PROGRESS AND EVENTS

1800 TO 1885.

PERIOD OF GERMAN RESTORATION.

1800. **Denmark and Norway**—The Northern Confederacy with Sweden, Russia, and Prussia attempts to compel Great Britain by force of arms to relinquish the Right of Search during war.

1800. **Great Britain**—A chain-bridge across the Tweed is opened. (The suspension principle had been used in the Himalayas for ages; there is a very ancient bridge of Alexander on the Upper Indus.) Convention of Vienna, providing subsidies for maintaining troops under arms. Act of Union with Ireland. The treaty of El Arisch is rejected by Lord Keith. Thomas Jackson writes the earliest modern English work on Applied Mechanics, and founds professorships for teaching that science.

1800. **France**—Egyptian campaign, Italian campaign, Austrian campaign. La Vendée pacified. Sugar is now largely extracted from beet root. *See* 1747. Canel invents mechanism for supplying oil to lamps evenly. Louis Arbogast publishes his 'Calcul des derivations.'

1800. **Russia**.—Invitation to European monarchs to settle national disputes by single combat at S. Petersburg.

1801. **Denmark and Norway**—The Northern Confederacy is dissolved. War against England.

1801. **Great Britain**—First imperial Parliament, 2 February. War in Egypt and in the Baltic. Improved distillation effected by Adam. *See* 1780 and 1150.

1801. **Germany**—Treaty of Luneville, 9 February, recognition of the Batavian, Helvetic, Cisalpine and Ligurian Republics. Territorial alterations in Westphalia, Hannover, Baden, Wurtemberg, and Bavaria.

1801. **France**—Annexation of Naples, Tuscany, Piedmont, &c. Evacuation of Egypt. Jacquard, of Lyons, invents the fancy loom, and makes his first model of it. Renaud Juste Haüy publishes his Treatise on Mineralogy, giving the earliest correct doctrine of the science of Crystallography; b. 1743, d. 1822.

1801. **Italy**—Piazzi discovers the planet Ceres, but at first imagines it to be a comet: Oriani first declares it to be a planet; discovered 1 January, 1801.

1801. **Russia**—Convention with England, and dissolution of the Armed Neutrality.

Record of Progress

1802. **Great Britain**—Improved life boats are built by Great-head. *See* also 1717.

1802. **France**—Treaty of Paris with the Porte, 25 January. Peace of Amiens, 25 March, with England and Spain. Convention with Prussia, 24 May. Consuls appointed for life. Hayti acquired. Cabanis publishes his first work on the Connection between the moral and the physical in man; a subject afterwards developed by Broussais.

1802. **Germany**—Wilhelm Olbers discovers the planet Pallas on 28 March, 1802.

1802. **Italy**—Pessuti (b. 1745, d. 1814) writes on occultations; he had also written on hydraulic trombes, and afterwards on capillary action; his new method of spherical trigonometry, and his Treatise on derived functions, were later.

1802. **Switzerland**—Revolt against the French occupation, which had lasted since 1797-98.

1802. **Russia**—The treaty of Jassy is confirmed; the tenure of the hospodar of Wallachia is laid down.

1803. **Great Britain**—Dalton asserts the principle of chemical proportion in his Manchester Memoirs. *See* 1777. Buonaparte insults Lord Whitworth. War against France begins 26 May. Emmett's insurrection in Ireland, 23 July. Patriotic funds are raised (1803-07) for widows and orphans.

1803. **Germany**—Cession of one-seventh of the territory of the Empire by the Diet of 25 February.

1803. **France**—Switzerland is annexed, February. Lubec and Hannover taken, June. Preparations for an invasion of England. Blockade of the Elbe.

1803. **Russia**—Founding of colleges and universities at Kazan, Charkov, and other places; and of the Moscow Botanic Garden.

1803. **Ottoman Empire**—Wars in Albania between Moslems and Christians. Subjugation of the Suliots.

1804. **Great Britain**—Dance defeats some French war ships with trading vessels, 15 February.

1804. **France**—Napoleon is nominated Emperor, 13 May, and crowned at Paris, 2 December. Jacquard now invents looms for ribbon-making and cloth-weaving.

1804. **Spain**—The government supplies four millions of money to France, then at war against England; the English seize some Spanish ships, 5 October. War is declared 12 December.

1805. **Great Britain**—Attack on the Boulogne flotilla by Smith, 31 August. Naval war.

1805. **Germany**—Bavaria with the Tyrol, and Wurtemberg, become separate independent kingdoms. Treaty of Vienna, 15 December, between Prussia and Austria.

1805. **France**—Sardinia annexed, 26 May; Genoa annexed, June. Third Coalition War, 9 August. Austrian campaign, ending with the Treaty of Pressburg, 20 December.

Record of Progress

1805. **Ottoman Empire**—Revolt of Serbs under Paswan Oglu; Russia claims protective power over them.

1806. **Great Britain**—Naval war; success of Stuart in Naples at battle of Maida, 6 July. Surrender of Buenos Ayres, 12 August. Herschel proposes the theory of the movement of the whole solar system towards the constellation Hercules. Brunel designs block-making machinery for ships' blocks. A crushing mill is used at Crowndale copper mines.

1806. **Prussia**—Hannover is annexed; war against England. The French seize Wesel; war against France. French occupation of Prussia, 15 October.

1806. **France**—The old Calendar is restored from 1 January, 1806, or 11th nivose de l'an xiii. Fourth Coalition war. Prussian campaign. Armistice of Charlottenberg, 16 November. Declaration of continental blockade under the Berlin Decree, 19 November. Warsaw occupied, 30 November. The barbaric custom of treating noncombatants as prisoners is introduced by Napoleon. Chaptal publishes his '*La chimie appliquée aux arts*'; and introduces applied chemistry in France; his other works were on Saltpetre, Tar, on Dyeing, and on Chemistry applied to agriculture. Biot and Arago continue the geodetic work in Spain of Delambre and Mechain.

1806. **Sweden**—Berzelius publishes his '*Researches in organic chemistry*,' a branch of science of which he was one of the most active founders; he had also adopted electric decomposition at an early period.

1806. **Germany**—The Rhine Confederation is formed 12 July. The Germanic Empire is dissolved, 13 December.

1807. **Denmark and Norway**—French alliance against England. The English take the fleet, 5 September.

1807. **Great Britain**—Alliance with Portugal, October. Russia declares war against England and Sweden, November. Gas-lamps are adopted in the streets of London; they become commonly used in 1814. *See* 1796 and 1798.

1807. **Germany**—Friedrich Koenig (b. Eisleben, 1775, d. 1833) invents a printing press.

1807. **France**—Campaign in Pohlen and Prussia; Peace of Tilsit with Russia for dividing Europe. Treaty for the partition of Portugal made at Fontainebleau, 27 October, with Spain. Junot enters Lisbon, 27 November. Milan Decree excommunicating the English, 17 December.

1807. **Russia**—War declared against the Porte, 7 January. The Dardanelles are forced by Duckworth, 19 February. Assignment of the Ionian Islands to France under Treaty of Tilsit, 7 July. Deposition of the hospodar of Wallachia, 30 August. War declared against England and Sweden, November. Occupation of Wallachia, beginning in December.

1808. **Sweden**—Gustavus IV. resists Russia. He is subsidised from England, and Sir John Moore takes 11 000 men to his help; but he drives Moore away, and seizes some British ships

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1808. **Great Britain**—Wellesley lands at Porto, 25 July. Battle of Vimiera, 21 August. Convention of Cintra; the French evacuate Portugal in August. Terms with France are refused. Sicily is held by the English. Slater obtains a patent for making chain cables.

1808. **France**—Napoleon demands some Spanish territories, 27 February. Revolt of Aranjuez, 18 March. Fernando VII., who became King of Spain on 19 March, abdicated on 1 May. Murat is crowned at Naples, 15 July. Murat enters Madrid, 23 March. Occupation of Rome, June. Joseph Buonaparte enters Madrid, 20 July. Battle of Vimiera, 21 August. Battle of Espinosa, 10 November. Napoleon restores Joseph, 2 December.

1808. **Germany**—The great domestic pest of modern times, the mechanical organ, is invented by Maelzel (b. Ratisbon, 1772), who died a natural death in 1838.

1808. **Italy**—Bettinelli (b. 1718, d. 1808) publishes his historical work 'On the rise of Italy in arts and customs since the year 1000,' before this date; perhaps about 1801.

1809. **Great Britain**—Retreat from Spain and in Portugal. Soult and Victor occupy Portugal, March 19. Walcheren expedition, August and September. The Ionian Islands are taken, 3 October. Heathcote invents the net-twist machine for lace weaving. *See* 1768. Circular saws are introduced. A floating harbor is made at Bristol.

1809. **Germany**—War of the Fifth Coalition against France, Baden, and Wuerttemberg, 9 April. Revolt of the Tyrol under Hofer, expulsion of Bavarians and French, April. Innsbruck taken, 15 May. Battle of Berg, 20 May. Battle of Isel, 12 August. Treaty of Schonbrunn, 14 October.

1809. **France**—Recovery of Portugal, 19 March. War of the Fifth Coalition, 9 April. Austrian and Tyrolese campaigns. Evacuation of Portugal, 11 May. Vienna occupied, 13 May.

1809. **Spain**—Conflicts at Corunna, 16 January; Ferrol, 27 January; Zaragoza, 21 February; Porto, 29 February; Cordova and Seville, November. Battle of Osuna, 19 November, severe defeat of Spaniards, loss of 45 guns, and 20 000 prisoners are taken. Conflict at Gerona, 12 December.

1809. **Italy**—Pope Pius VII. (Chiaramonti) is arrested by General Radet; Napoleon had already, in 1806, declared or nominated the Pope his Viceroy.

1809. **Russia**—War declared against Austria, 5 May. Peace of Frederikshaven with Sweden, 17 September. Acquisition of Finland, Aland, East and West Bothnia, by treaty.

1810. **Sweden**—Berzelius publishes his work on chemical proportions; his atomic theory resembled that of Dalton. *See* 1806.

1810. **Great Britain**—The English capture a squadron of the Franco-Neapolitan fleet, and repel an attack on Sicily, 20 July. Naval warfare. Campaign of Wellesley in September; he defeats Murat and Massena. The Ministry refuses supplies and reinforce-

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ments to Wellington. Retreat of the British to Torres Vedras, 15 October. Wellington joins Romana, 20 October. Surgeon Millington proposes a military ambulance establishment and corps. Brewster makes discoveries in optics, and uses reflectors. Leslie makes artificial ice with sulphuric acid. *See* 1782.

1810. **France**—Treaty of Paris, 6 January, with Sweden. The Tyrol is subdued by the Bavarians, February. Successes at Ciudad Rodrigo, Vigue, and Almeida, in July and August. Imperial marriage, 11 March. Annexation of Hannover, Westphalia, and Holland, 13 December. Arago makes some discoveries in polarised light, and in optics. Death of Francois Peiron, traveller in the South sea, observer of sea temperature, marine zoologist; writer on dysentery and the use of betel.

1810. **Spain**—The Spanish troops maintain war in Andalusia with little success.

1810. **Russia**—The annexation of Wallachia is declared, 21 January. The Ottoman war continues.

1811. **Great Britain**—Regency of the Prince of Wales. Successes of Wellesley against Massena, Soult and Girard. Improvements in paper-making by Dickinson.

1811. **France**—Napoleon II., a boy, is declared King of Rome. Battle of Pauma, 10 March, defeat of Rémon. The Spanish war continues under Suchet, Soult and Massena. Hamburg is annexed.

1812. **Sweden**—Pommern and Rugen, acquired in 1810 under the Treaty of Paris, are seized by the French, 17 January. Alliance with Russia against France, 5 April. Alliance with Great Britain, July.

1812. **Great Britain**—Successes of Wellesley in Spain; entry into Madrid, 12 August; he is defeated by Soult at Battle of Alba, 9 October. Third British retreat to Portugal, 20 November. Subsidy to Portugal. Clauny, of Sunderland, makes safety lamps for miners. Chain cables are used in the navy.

1812. **France**—Forced treaty with Prussia, 14 March. The Grand Army is prepared, April. War is declared against Russia, 22 June; passage of the Niemen, 24 June; battle of Smolensk, 17 August, battle of the Borodino, 7 September; Moscow occupied, 14 September. Defeat of Napoleon at the battle of Malo-Jaroslavitz, 24 October; a retreat on the original line of advance is now forced. Disastrous retreat, and passage of the Niemen, 12 December. Defection of Prussian troops, 29 December. Death of Etienne Louis Malus (b. 1775), discoverer of the polarisation of light. About this time Hausmann (b. 1749, d. 1824) adopts the English mode of bleaching with chlorine, and English blue; he also uses oxalic acid in printed fabrics, and fixes prussiate of iron on cottons; all English methods introduced by him in France.

1812. **Spain**—Surrender of Valencia and Catalonia. The command of the Spanish armies is given to Wellesley on 22 September; but no alliance with England exists yet.

1812. **Russia**—Treaty of Bucharest, 28 May; Wallachia is restored to the Porte, and Servia is made tributary to the Porte;

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Anapa is ceded ; Bessarabia unto the Pruth is acquired. Invasion of the Grand Army, and occupation, 24 June to 12 December.

1813. **Sweden**—War against France is declared ; the army proceeds to Berlin to join the allies. Denmark makes an offensive and defensive alliance with France, 10 July, and declares war, September. Holstein is occupied, December.

1813. **Great Britain**—Successes of the allied armies under Wellesley, from February to December. Howard makes improvements in sugar refining. Davy makes a safety lamp. *See* 1812. Brown devises a machine for testing chain cables.

1813. **Prussia**—Treaty of Kalish with Russia, February 28. Evacuation of Berlin, 4 March. War declared against France, 16 March ; and the war of the Sixth Coalition begins.

1813. **Germany**—Second treaty of Kalish between Austria and Saxony, March. Convention of Reichenbach, 14 June. Baden, Wurtemberg, and Bavaria abandon the French. Treaties of Tauroggen and Fulda. Austria joins the allies on 21 August.

1813. **France**—War of the Sixth Coalition, 6 March. Campaign in Saxony. Battle of Bautzen and Reichenbach, 20 and 21 May. Armistice of Pöschwitz, 4 June. Battle of Leipzig, 16 to 19 October. Insurrection at Amsterdam, 16 November. Manifesto of the allies, 1 December. France is invaded.

1813. **Spain**—An alliance is made with England and the allied powers, 8 December.

1813. **Italy**—Death of Giuseppe Jacopi, comparative anatomist, writer on the retrograde movement of the lymphatics, and on the use of the spleen.

1813. **Russia**—Treaty of Gulistan, 12 October, with Persia. Acquisition of Daghestan.

1814. **Great Britain**—Battle of Garris, Orthes, Tarbes, and Toulouse. Genoa and Lyons surrender. Death of Joseph Bramah, inventor of improved locks and steel pens, of a printing press for bank-notes, and a protective paint for wood ; he improved steam boilers, and invented a water-tight valve for the hydraulic press.

1814. **Germany**—Campaign in France, January to April. Convention of Vienna, 28 September, putting Saxony under Prussian control. Congress of Vienna, 10 November.

1814. **France**—Defensive campaign in France ; battle of Fère Champenois, 25 March ; capitulation of Paris, 31 March ; exile of Napoleon, 4 April ; entry of Louis XVIII., 4 May ; treaty with the allies, 30 May ; treaty with Spain, 20 July. Congress of Vienna, 10 November ; redistribution of territory throughout Europe.

1814. **Spain**—Ferdinand VII. is restored, 14 May.

1814. **Italy**—Murat makes a truce with the English in Sicily, February. Dissolution of the French kingdom of Italy by treaty, 4 and 5 April. Francis IV. is restored in Modena. Genoa surrenders to the English, 18 April, and joins Sardinia on 14 December. Mantua and Venice are restored to Austria. The Grand Duchy of Tuscany is restored under Ferdinand III. ; the Duchy of

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Lucca is made independent. Chiaramonti is replaced as Pope Pius VII. in the Papal States, and he afterwards restores the Jesuits and the Holy Office of Inquisition. Giuseppe Piazzi (b. 1746, d. 1826) completes his catalog of 7646 stars.

1814. **Switzerland**—Death of Von Fellenberg, founder of agricultural institutes and schools.

1815. **Great Britain**—French war, 30 April to 20 November. Treaty of Paris. A British attack on New Orleans is defeated by General Jackson, 8 January. End of the Nipalese war. Commencement of building societies—actually house-purchasing societies—at Kulkudbright, by the Earl of Selkirk.

1815. **Prussia**—Acquisition of half of Saxony, the Lower Rhine, and other territory, 18 May and 15 July.

1815. **France**—Entry of Napoleon into Paris, 20 March. Battle of Ligny, defeat of the Prussians. Battle of Quatre-Brais, drawn battle. Battle of Waterloo, 18 June. Abdication of Napoleon, 21 June. Treaty of Paris, 20 November, reducing France to its limits in 1790. Clarification of vegetable substances by Martineau.

1815. **Germany**—New Confederation; Congress of Vienna; territory redistributed, 8 and 9 June.

1815. **Russia**—The Czar is proclaimed King of Pohlen, 20 June, and grants it a new constitution, December.

1816. **Great Britain**—Riots in England. Bombardment of Algiers. Christian slavery is stopped. Ashantee attacks. The pillory is abolished except in cases of charge of perjury. A British minister refuses to kow-tow at the Chinese Court.

1816. **Sweden**—The Norwegian hereditary nobles are suppressed.

1816. **France**—Baon Cuvier publishes his 'Animal Kingdom'; his 'Comparative Anatomy' had preceded this, c. 1805.

1816. **Italy**—Death of Ruffa, who introduced the use of felspathic sand in making porcelain; wrote on smectic clay, on the pebbles of Nau, and on the effect of light and heat on animal bodies.

1817. **Great Britain**—Pindarri and fourth Maratha War. A new constitution is granted to the Ionian Islands. Schools established in India. Total abstinence is proposed as a mode of reclaiming drunkards. Lithography and zincography are introduced generally. *See* 1796 and 1799.

1817. **Spain**—Abolition of the slave trade.

1817. **Germany**—Wilhelm Olbers discovers the planet Vesta on 29 March. He also discovered several comets.

1817. **Italy**—Death of Filippo Re, writer on agronomy.

1818. **Great Britain**—Parliamentary papers on bad trade and riots. Abolition of 'Wager by Battel.' Houses are heated with steam. Abolition of Tyburn tickets of exemption.

1818. **Prussia**—Congress of Aachen, September to November, of Prussia, Austria and Russia, about ending the British military occupation of France. Convention of withdrawal, 8 October.

1818. **Germany**—New constitutions are granted to Bavaria, Wurtemberg and Baden.

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1818. **Switzerland**—Pestalozzi introduces humanity in teaching children at schools, &c.

1818. **Ottoman Empire**—Suppression of the Wahabi revolt under Abdullah.

1818. **France**—Gas illumination is introduced by Baron Cagniard de la Tour, first at the Hôpital S. Louis, and at the royal forges; he also invented screw bellows, and the siren. Death of Monge, supposed inventor of descriptive geometry.

1819. **Great Britain**—Assistance is given to emigrants to the Cape of Good Hope, resettled in 1806. Large purchases of land from the Maories of New Zealand, where the first settlement dated from 1814. Settlement at Singapur. Reform meetings. Steel engraving is introduced by Heath and Perkins of Philadelphia.

1819. **Prussia**—Encke determines the periodicity of a comet of short period; and from this deduces much important astronomical knowledge. *See* 1705.

1819. **Germany**—A congress of German powers at Karlsbad, 1 August, consults on the modes of preventing revolt, of suppressing secret societies, and of controlling printed publications. Friedrich Liszt introduces the Zollverein and the railway system, 1819–24.

1819. **France**—Fresnel proposes improved reflectors for light-houses (already designed by Biewster); his writings on light, diffusion, polarisation, and on combining the vibratory and undulatory theories, are celebrated.

1820. **Great Britain**—Accession of George IV. Cato Street conspiracy. Drawn lead water-pipes are used instead of soldered sheet lead cylinders. The Nautical Almanac is reformed and enlarged by Francis Baily and others. Death of Sir John Jackson, naval controller (for Lord Keith) during the French war, who proposed many reforms; among them the abolition of quarantine; he also founded free schools, and started the scholars in life.

1820. **Prussia**—Belladonna is discovered to be a preservative against scarlet fever.

1820. **Germany**—Congress of monarchs at Trappau in October about preventing revolts and riots.

1820. **Spain**—Revolution under Riego; a new constitution is granted. Death of Don Juan Escoigniz, the epic poet, who also translated many English poems.

1820. **Italy**—The Carbonari under Pepe force a new constitution from Ferdinand I. of Naples, 18 July. Segato, the anatomist, during his travels about this time in Egypt and Senaar, discovers a mode of petrifying corpses in a flexible state, and in their natural colour and form; some of his specimens exist at Florence, but the secret was lost.

1820. **Russia**—Expulsion of the Jesuits. Opening of the Polish Diet.

1820. **France**—Arago deduces that a rotary motion is developed by magnetism; but Fazzini afterwards proves that the repulsive

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force, causing daily variation of the magnetic needle, is due to the effect of light on the magnetism.

1821. **Great Britain**—Coasting steamers now run in the North Sea and in the English Channel. Lord Cochrane introduces naphtha lamps. Lester discovers a mode of driving hydrogen out of mines. Snow Harris applies lightning conductors to the ships of the Royal Navy, consisting of a series of lapping copper plates. Death of John Rennie, engineer of Plymouth breakwater, who first used iron in large bridges at Southwark bridge.

1821. **France**—Military conspiracy and plots, August. Death of Napoleon I., 5 May. M. Fresnel brings forward the theory of double refraction.

1821. **Italy**—Austrian entry into Naples; defeat of Pepe at Rieti, 7 March. Naples occupied, 20 March. Ferdinand I. is restored under an Austrian occupation, 15 May.

1821. **Russia**—An improved saw-mill and a new threshing-mill are invented. Kuhalevsky makes an astronomic watch.

1821. **Ottoman Empire**—Revolt of Moldavia and Wallachia, 6 March. Revolt of the Morea, 4 April. Massacre of Greeks, 22 April. Battle of Amphi, 1 May. Liberation of the Morea, 1 June. Moldavia and Wallachia are subdued, 19 June.

1822. **Great Britain**—Ice is imported from Norway for the use of London pastry-cooks, on account of the mildness of the season. An analysis of sea-water yields muriate of ammonia.

1822. **Denmark**—Death of Viborg, agonomist and veterinary surgeon, who wrote on planting quicksand, raising poultry, and horse-doctoring.

1822. **Sweden**—James Berzelius publishes his 'Annual Account of Chemical Progress of all Nations.' His new system of mineralogy had been published in 1812.

1822. **France**—Jean Fourier publishes his works on the theory of heat, its existence, propagation, and application to liquids, in a collective form. Death of Renaud Haüy, physicist, geologist, and electrician, who discovered the laws of crystallography.

1822. **Italy**—Death of Venturi, the physicist, who wrote on optics, color and artillery, and on the works of Da Vinci.

1822. **Austria**—The Congress of Verona, 14 December, decides on the Austrian evacuation of Naples and Piedmont.

1822. **Ottoman Empire**—The Greeks declare independence, 27 January. Scio massacre, 11 April. Athens is lost, 22 June. Three Greek successes in August. Corinth is lost, 2 October. The Albanians are subdued.

1823. **Great Britain**—First Burmese war. First Ashanti war. The tea-plant is discovered in Assam, a find that leads to Indian tea-growing. Birkbeck founds mechanics' institutes.

1823. **France**—Intervention in Spain is declared, 28 January. Entry into Madrid, 24 May. Investment of Cadiz, 25 June. Battle of the Trocadero, 31 August. The king is delivered, 1 October; the Cortes are dissolved, and the rebels are beheaded, October.

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1823. **Italy**—Death of Carlo Verri, agronomist, writer on viticulture, and growing mulberry trees.

1823. **Germany**—Publication of the 'Mathematisches Wörterbuch,' the joint labor of Klugel, Velthusen, Henke, Bruns and Crell; afterwards continued by Mollweide and Grunert.

1823. **Ottoman Empire**—The Greek revolt is maintained. Massacre at Pergamo. Battle at Carpenisi, 17 August.

1824. **Great Britain**—Expeditions in Assam and in Tenasserim. Defeat of MacCarthy, governor, by the Ashantis. Defeat of Ashantis, 11 July; this war lasts till 1826. See 1816 and 1823.

1824. **Germany**—Severe commercial depression throughout the country.

1824. **France**—Joseph Nicéphé (b. 1785, d. 1833) discovers his mode of fixing photographic image, called Daguerrotype. Afterwards, Claude Nicéphé (b. 1805) proposes photographing on glass plates, and wrote on Heliography. He discovered a dye, and wrote on the fumes of iodine, phosphorus and sulphur. Baron Cuvier publishes his 'Researches in fossil bones,' and founds the science of palaeontology in France. His 'Natural history of fish' followed this.

1824. **Ottoman Empire**—Ottoman reprisals on the Greeks of Crete and of the Peloponnesos. Evacuation of Moldavia, 23 November.

1825. **Great Britain**—Exchange of territories and settlements in India and Sumatra with the Netherlands. Faraday discovers benzene, the basis of an enormous chemical development. Year of bubble speculation based on projects of many sorts, chiefly mines. David Douglas, the exploring botanist (b. 1798, d. 1834), introduces many new plants and shrubs.

1825. **France**—Death of the Comte de S. Simon, the social and political economist, who founded a school of followers.

1825. **Portugal**—Acknowledgment of the independence of Brazil.

1825. **Russia**—Military revolts at S. Petersburg and at Moscow, December.

1825. **Ottoman Empire**—The Greeks request English intervention, 24 July.

1826. **Great Britain**—The nutritive properties of oilcake are discovered. Tobacco is now grown in New South Wales. Rise of joint stock banks.

1826. **Germany**—Death of Fraunhofer, the discoverer in optics and spectrum analysis.

1826. **France**—François Fourier founds the first Socialist colony at Condé-sur-Vosges; his teaching aimed at coarse materialism of substantial advantages for a certain number of workpeople, with indifference to the general detriment of nations and all other classes. A pretended admiration of virtue was part of the philosophy that actually opposed virtuous men and good principles, by putting gain as the first and sole aim, and otherwise

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was negative and polemic. Death of Pinel, who first proposed humane treatment in mental disease. Death of Laennec, who adopted auscultation and percussion, before known to Auenbrugger.

1826. **Russia**—Treaty of Akerman, 4 September, confirming the treaty of Bucharest of 1812, with other concessions from the Porte.

1827. **Great Britain**—London University is founded free from ecclesiastical teaching or control. Treaty of London, 6 July, with Russia and France, about Greek independence. Battle of Navarino, 20 October; destruction of the Ottoman and Egyptian fleets. Neilson discovers the use of the hot blast, and afterwards patents the invention.

1828. **Great Britain**—The piratical port, Carabuso, is destroyed, 31 January. Rodger invents the dialytic telescope. The hydraulic jigger is adopted at S Blaize. Death of Sir William Congreve, inventor of several things, among them Congreve rockets.

1828. **Germany**—Electric decomposition is used by Wohler in separating aluminium. *See* 1806.

1828. **France**—Expedition to the Morea, 17 August to October, for removing Egyptians and Turks.

1828. **Italy**—Revolt of Neapolitan Carbonari suppressed. Francis I. bombards Tripoli without success, 20 August. Death of Stulli, who introduced vaccination in Illyria, wrote on various plagues, epizoa, scarlet fever, and on earthquakes.

1828. **Portugal**—The Civil war of the Miguelists begins.

1828. **Russia**—Expulsion of Russians from the Ottoman Empire, January. War declared, 26 April. Death of Nicolas Demidoff, writer on political and private economy.

1828. **Ottoman Empire**—Convention for abandoning the Morea, 6 August. Evacuation of it, 7 October.

1829. **Great Britain**—Catholic Relief Bill. The diving helmet is introduced by Siebe and Gorman in London. Death of Sir Humphrey Davy, the discoverer in chemistry, who applied chemistry to agriculture; *b.* 1778.

1829. **France**—Popular demand for a constitutional monarchy. Death of Molard, inventor of chain-brakes and shoe-brakes, dock-cranes, of a sawing lathe for curves, and a machine for making wooden screws; he also introduced agricultural machinery, improved ploughs, thrashing, winnowing, and chaff-cutting machines.

1829. **Spain**—Cadiz is made a free port.

1829. **Russia**—Treaty of Hadrianople, 14 September; large indemnity obtained from the Ottomans. Discovery of diamond mines in the Ural mountains.

1830. **Great Britain**—Accession of William IV. Reform Bill 1832. Conference of London about Belgium. Earl Stanhope invents a calculating machine. About this time John Herschel, the astronomer, invents the actinometer. Death of Parkinson, the mathematician.

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1830. **Netherlands**—Revolt of Brussels and Antwerp; independence is proclaimed, 10 November. Revolt of Luxemburg.

1830. **Germany**—Revolution in Saxony. The Duke of Brunswick is expelled by insurgents.

1830. **France**—Algerian expedition, 25 May. Ordonnances de Juillet interfering with liberty of election. Revolt at Paris, 27 to 29 July. Abdication of Charles. A constitutional government is formed under Louis Philippe, duc d'Orléans—a Ministry is formed 11 August. Franchot invents the moderator lamp, having an even supply of oil. Baron Cagniard de la Tour—*See* 1818—about this time invents a chronometer balance, a screw pump, a cannon pump, and a machine for observing the flight of birds; also other things. Death of Jean Fourier, the physicist. *See* 1822.

1830. **Russia**—The incorporation of Circassia begins. Erzurum is restored to the Ottomans.

1830. **Ottoman Empire**—The independence of Greece is acknowledged, 25 April. Revolt of Albania, May. Crete is assigned to Egypt.

1831. **Italy**—Death of Rolando, writer on physiologic and pathologic induction; on excitability, the brain, and the nervous system; founder of the modes of Gall and Spurzheim.

1831. **Great Britain**—Cholera in Europe and in England. O'Connell and others are arrested. Union formed of Congregationalists out of older Dissenting sects and parties. The first presumed Asiatic cholera arrived at Sunderland on 26 October, 1831, and was in 1832 all over the United Kingdom and in France. In Europe it lasted from 1830 to 1837. Commission for regulating emigration.

1831. **Belgium**—The Hollanders recommence war, 4 August. Entry of French troops, 23 August. A treaty fixing Belgian limits is drawn up in London, 15 November.

1831. **France**—Brun Rollet, called Khwāja Yakub, begins his long explorations about the Upper Nile; he reaches 4° north latitude, and dies at Kartum in 1859.

1831. **Germany**—Death of Escholtz, the marine naturalist and zoologist.

1831. **Ottoman Empire**—Revolt of Mehemet Ali in Egypt; the Egyptians take Gaza and Accho.

1832. **Great Britain**—Slavery is abolished in the British Antilles. Some men are made peers of England merely to pass a blocked Reform Bill, which then passes the Commons. Chance and Hartley reintroduce the manufacture of sheet-glass.

1832. **France**—Occupation of Ancona, 23 February. Bombardment of Antwerp, 4 to 23 December. Death of Libes, the physicist and electrician, who experimented on the effect of silk in contact, the basis of the dry electric pile. Death of Remusat, translator of Chinese, who wrote a history of Buddhism. Death of Champollion, who deciphered Egyptian inscriptions and hieroglyphs.

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1832. **Italy**—Death of Oriani, astronomer and geodesist.

1832. **Greece**—Prince Otto of Bavaria is elected king, 8 August.

1832. **Sweden**—Death of Rudolph, the veterinary naturalist, writer on entozoa.

1832. **Denmark**—Death of Rask, collector of old Norse literature and of Persian poems.

1833. **Great Britain**—The High Church revival movement begins. The result is a marked division into three parties within the Church of England, termed the High or ritualistic, the Low or puritanical, and the Broad or original church. The abolition of all slavery throughout the British empire is decreed on 28 August, 1833, to take effect from 1 August, 1834. Indian commerce and Chinese tea trade is thrown open to all nations. American ice is imported in India. Grant introduces the clean process of making bread and biscuit by machinery.

1833. **Germany**—Institution of the Zollverein, 22 March, for German States, based on the Prussian Zollverein of 26 May, 1818; the uniform tariff to take effect from 1 January, 1834. Death of the philologist, Grotefend, who deciphered cuneiform inscriptions. Death of Johann Meckel, the pathologist and comparative anatomist. Death of Sprengel, writer on pathology, medicine, surgery, botany and herbs.

1833. **Ottoman Empire**—Acknowledgment of Mehemet Ali as ruler of Egypt, 6 May.

1833. **Italy**—Insurrection under the influence of the "Young Italy" party. Death of Romagnosi, who discovered in 1802 the effect of the galvanic current on the magnetic needle before Oersted, and wrote on the distribution of water in canals.

1834. **Great Britain**—Burning of the Houses of Parliament. Lucifer matches come into use. A Fire brigade is established in London. The cost of the abolition of slavery to the Government is declared to be twenty millions sterling; but the private losses on estates are enormous, as these become valueless.

1834. **France**—Death of Labillardière, botanist of Syria and of New Holland.

1834. **Italy**—Death of Rusca, who wrote on cholera, and on care of the sick.

1834. **Spain**—Quadruple alliance of European powers for supporting Queen Isabella, 21 April. The Spanish nobles decree the expulsion of Don Carlos, 30 August.

1835. **Great Britain**—New powers are given to municipal corporations. Death of John McCulloch, geologist and mineralogist.

1835. **Prussia**—Ordinance inflicting penalties on parents and guardians, whose unvaccinated children catch small-pox.

1835. **Italy**—Death of Nobili, the electrician, discoverer of the induction theory and that of the galvanic pile, inventor of the thermo multiplier, the metalloscope, and the double electric needle; improver of the galvanometer.

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1835. **France**—Death of Dupuytren, the inventor of several new surgical operations.

1836. **Great Britain**—Ecclesiastical Commissioners are appointed to control the funds of the National Church.

1836. **Germany**—The first railway is made from Nurnberg to Fuerth. *See* 1819.

1836. **Italy**—Death of the physicist, Morichini, who discovered fluoric acid in fossil ivory, and the magnetising power of the violet rays of the solar spectrum on needles ; also many other things.

1837. **Great Britain**—Accession of Victoria, aged 18. The civil list and the expenditure on royalty and the court is greatly reduced. Rebellion of Papineau. Entire abolition of the pillory. *See* 1816.

1837. **Spain**—Dissolution of monasteries.

1837. **France**—Death of Francois Fourier, first founder of a socialistic colony, which existed for a few years at Condé-sur-Vosges.

1837. **Italy**—Death of Fazzini, the electrician, experimentalist with induction coils, who discovered the effect of light on diurnal magnetic variations.

1838. **Great Britain**—Application of oxyhydrogen to deepening bore-holes. Southwood Smith draws attention to the sanitary state of Whitechapel, Bethnal Green, the Seven Dials, and other parts of London peopled by descendants of the French Huguenots.

1838. **France**—Death of Henri Desruelles, physician for diseases of children and urethral complaints, writer on the abuse of mercury. Death of Broussais, physiologist and pathologist, who wrote on the moral and physical connections.

1838. **Italy**—Ferdinand II. breaks the treaty of 1816, and forms a private sulphur monopoly.

1839. **Great Britain**—Kabul war. Aden is purchased. Riot of Chartists at Newport. Chinese war. Goldsworthy of Bude improves illumination by supplying oxygen to a flame. Wood pavement is first adopted near Whitehall. Heath's experiments with manganese and carbon result in producing good steel from English iron. Reid invents a chemical abacus for use with chemical compounds.

1839. **Netherlands**—Division of Luxemburg between Belgium and the Netherlands.

1839. **France**—End of a Mexican war, 30 November, 1838, to 9 March, 1839. Peace of Vera Cruz. Daguerre's photographic process is known, and is publicly rewarded. Death of Jean Huzard, veterinary, who much improved the breed of cattle in France.

1839. **Spain**—Peace of Vergara, and flight of Don Carlos, 14 September.

1839. **Ottoman Empire**—Egyptian war renewed, May. The fleet deserts to the Egyptians, 4 July.

1840. **Great Britain**—Union of Upper and Lower Canada.

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Convention of London about Syria. Military intervention in Naples about the sulphur monopoly. Some Boers and slave owners, descendants of French Huguenots, leave the Cape of Good Hope and settle at Natal. Penny postage throughout the United Kingdom.

1840. **Italy**—Death of Scarpellini, who wrote a history of physics, and invented a very delicate hydrostatic balance.

1840. **France**—Death of Poisson, mathematician, who wrote on applied mechanics, heat, capillarity and secular inequality of planetary orbits.

1840. **Russia**—Expedition against Khiva.

1841. **Great Britain**—New Zealand becomes a separate colony. Limitation of death punishment to certain presumed offences.

1841. **France**—The English laws about slave trade are adopted, 20 December.

1841. **Germany**—Death of Ignatz Dollinger, comparative anatomist and physiologist. Death of Wilhelm Krug, writer on military science.

1841. **Switzerland**—Death of Pyramus de Candolle, proposer of a natural botanic system, author of several works, and of a *Prodromus*, describing one-half of the known vegetable kingdom on his system, after 16 years of labor.

1842. **Great Britain**—Peace made with China. Five ports are opened to English commerce. Disasters on withdrawing the troops from Kabul. Consolidation of some prisons of London.

1842. **France**—A French admiral seizes the *Maiquesas* and *Tahiti* Islands without orders. Death of Engelmann (b. Elsass 1788), the inventor of chromo-lithography of the modern sort. There had been some earlier Italian invention of printing in colors.

1842. **Belgium**—Death of Van Mons, the agronomist and horticulturist, who introduced the chemical nomenclature of Lavoisier.

1843. **Russia**—Decree of Emperor Nicholas I., 14 April, ameliorating the condition of the serfs.

1843. **Great Britain**—Improvement in silvering glass by Drayton. An atmospheric railway is made between Kingston and Dalkey, near Dublin. Copyright Act. Anti-Corn-law meetings. Death of Sir Keith Jackson, companion of Bunes; explorer of the Indus Valley; and writer on the expedition to Kabul.

1843. **France**—Death of Dombasle, the agronomist, who made agricultural machines, adopted calcareous manure, introduced flax cultivation, and improved the fleeces of sheep.

1844. **Great Britain**—The public baths and washhouses of London are erected with public subscriptions. Lord Rosse completes an enormous reflecting telescope at Birr Castle. Brunton uses compressed air in drilling bore-holes in Cornwall. Death of John Dalton, the chemist, and proposer of the atomic theory. Death of Francis Baily, who made a new edition of Flamsteed's *Star Catalogue*. Death of Charles Lyell, the scientist.

1844. **France**—The seizure of the *Tahitis* is disavowed,

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29 February. Attack on Morocco. Death of S. Hilaire, the zoologist writer on acclimatisation, and anatomical matters, chiefly about mammals.

1845. **Great Britain**—Sikh war. Franklin's expedition. Repeal of taxes on glass. The knife-buddle is used in the Lisburne mines, Cardigan. Culmination of the railway speculating mania; 1428 new lines are proposed this year. Boards of health and Local boards for sanitary purposes are established. Consolidation of Acts for compulsory purchase of land for public purposes. Death of James Johnson, writer on the effect of tropical climates, sedentary habits, British air, the gout, &c.

1845. **Sweden**—Experiments with rifled muskets at Aggerhaus on 8 April.

1845. **France**—Death of Jean Huot, geologist, mineralogist, and naturalist.

1846. **Great Britain**—Repeal of the Corn laws. Potato famine in Ireland for four years. The hydraulic crane is invented by Armstrong at Newcastle; it is improved in 1851.

1846. **Denmark**—The claims to Holstein, but not to Sleswik, may be submitted to arbiters, 8 July.

1846. **Austria**—Revolt of the Republic of Cracow; it is abolished; Cracow is annexed to Austria.

1846. **Russia**—A Polish revolt is suppressed; and direct annexation follows in 1847. Death of Von Kotzebue, the explorer in Arctic and Antarctic regions; fl. 1806 to 1826. Death of Krusenstern, navigator and discoverer, in 1810-15.

1846. **Italy**—Death of Zamboni (b. 1776, fl. 1805), inventor of a new galvanometer, who described a new dry pile, and a perpetual electrometer, in 1820, wrote on dynamic electroscopy, and on the electro chemistry of the voltaic pile; described a new hydrostatic apparatus, and proposed a theory of perpetual motion.

1847. **Great Britain**—Rush of gold diggers to California. Kaffir war. England is taxed to the extent of ten millions sterling for the good of the Irish. Foreign postal stamps used. An inventor, Sturgeon, receives a pension. American sewing machines are introduced. Paper is now made of straw. Perforated bricks and rubber tubing come in vogue. Simpson, of Edinburgh, uses chloroform.

1847. **Sweden**—Death of Graberg-hemso, writer on the ancient Skalds, and about the Goths that sacked Rome; also on Morocco and Central Asia; statistician and cosmographer.

1847. **France**—Vidi invents the aneroid barometer. Surrender of Abd-el-Kadir, 23 December. Death of the botanist, Dutrochet, who investigated exosmose and endosmose. Death of Pariset, writer on yellow fever and plague.

1847. **Switzerland**—End of the civil war of the Free corps and the Sonderbund.

1847. **Denmark**—Death of Finn Magnussen, mythologist, antiquarian writer on the runes of Denmark, Greenland, and Russia.

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1847. **Italy**—Death of the zoologist, Giuseppe Géné, who wrote on destructive insects and hymenoptera.

1848. **Great Britain**—Chartist riots; Smith O'Brien's riot in Ireland. Large emigration. Death of George Stephenson, who greatly furthered the general adoption of the railway system for passenger traffic in 1814 to 1825. Second arrival of cholera.

1848. **Denmark**—Revolts in Sleswik and Holstein, 24 March. Prussian occupation, April and May.

1848. **Europe**—Insurrection and revolt in almost every European country.

1848. **France**—General Bugeaud fails in his duty to protect the king against a Parisian mob; the king escapes, 26 February. Louis Napoleon is elected President of the French Republic, 11 December.

1849. **Great Britain**—Second Panjab war. Improvements in sugar refining by Scoffern. Randolph improves air-compression drills. Gutta-percha is much used. Death of James Ransome, inventor of several agricultural machines.

1849. **Germany**—Death of Josef Koch, botanist and entomologist of Germany and Switzerland.

1849. **Russia**—Treaty of Balta Limau with the Porte. Intervention in Hungary in May.

1850. **Great Britain**—Death of William Kirby, the entomologist of England, New Holland, and North America. Death of William Prout, who wrote on renal disease. A Papal hierarchy is established, September. Monasteries and convents are now entirely free from inspection and control. Blockade of Greece, terms made, 30 July. James Beeching of Great Yarmouth proposes a model lifeboat. James Young of Glasgow patents distilling oil from Scotch shales; he uses the resulting paraffin for illumination. Intramural burial ceases, 1850-54.

1850. **France**—Death of Gay Lussac, the physicist and experimentalist, inventor of the alcoometer, who discovered oxygenated chloric acid, investigated sodium, potassium, and borax, and took observations at an altitude of 7 000 mètres. Death of the chemist, Labarraque, who made the presumed discovery of the use of chloride of lime as a disinfectant in 1820.

1850. **Denmark**—Peace of Berlin, 2 July. Reoccupation of the duchies. Concessions in Africa to Great Britain.

1850. **Spain**—Filibusters from the United States attack Cuba.

1850. **Italy**—Return of Ferretti, Pio Nono, to Rome, 12 April.

1851. **Great Britain**—First general census. International Exhibition. Discovery of goldfields at Bathurst by Hargreaves; also at Ballarat, near Melbourne. Abolition of the window-tax. Richard Burton, subaltern in the Bombay army, makes the first Christian pilgrimage to Mekka Sharif, and is known as the Hajji.

1851. **Germany**—The Dresden Conference closes, and the Old Diet of Frankfort is to be restored. Death of the mathematician Jacobi, writer on elliptic functions.

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1851. **France**—Coup d'Etat, 2 December. Universal suffrage. Arrest of 180 members of the National Assembly. Death of Lallemand, who wrote on seminal and urinary disease, zoosperms and encephalus. Death of Pons, who discovered thirty-seven comets between 1801 and 1827.

1851. **Russia**—The dispute with the Porte about pilgrims to Palestine begins.

1851. **Denmark**—Death of Oerstedt, discoverer of electro-magnetism, adopted by Wheatstone; this is also ascribed to Romagnosi.

1852. **Denmark**—Prince Augustenburg renounces his claims for 3 500 000 dollars, 30 December.

1852. **Great Britain**—Death of Wellington, 14 September. Advertising vans are prohibited. Death of Thomas Thomas (b. Crieff), scientist, chemist and mineralogist.

1852. **Germany**—Death of Jahn, the founder of gymnastic training in Germany, who had thus contributed much to the successes against the French, and the freedom of his country.

1852. **France**—Opponents are transported, 10 January. Concessions about pilgrims obtained, 14 February. Plebiscite for the Empire, 21 November. Louis Napoleon becomes emperor, 2 December.

1853. **Great Britain**—Trunk roads and telegraphs introduced in India; also a railway. Third arrival of Asiatic cholera, 1853-54. Cochin China fowls introduced largely. Receipt stamps are ordained. The tax on advertisements is abolished. Death of Strickland, the geologist and zoologist. Death of Pereira (b. Shoreditch, 1804), writer of a pharmacopeia.

1853. **Netherlands**—A Papal hierarchy is introduced.

1853. **France**—Political amnesty, 2 February. The State begins to purchase conceded canals; this policy is continued till 1880, when most of them are bought, freed from toll, and used for slow transport. Death of Renguard, bibliographer of books, manuscripts, drawings and engravings.

1853. **Russia**—Concessions about pilgrims obtained, 19 May. Manifesto of Russia, 26 June. Occupation of the Danubian principalities, 2 July. The Ottomans declare war, 5 October. France and Great Britain oppose the Russian claim to entire sovereignty over Wallachia. It is very doubtful if it was ever thus claimed, though perhaps intended.

1854. **Great Britain**—French alliance, and war against Russia, 28 March, 1854, to 30 March, 1856. The rifled cannon of William G. Armstrong are first used in the Crimean campaign. Patriotic funds are raised, 1854-57.

1854. **Italy**—Death of Majocchi, writer on galvanism, lightning conductors, and hygrometers. Death of Melloni, inventor of the electroscope, improver of Nobili's thermoscope, writer on light and on radiant heat.

1854. **France**—Death of Leverrier, who discovered Neptune at the same time as John Adams.

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1855. **Great Britain**—Death of Sheepshanks, the mathematician. Meetings demanding administrative reform of war management. Death of George Johnston, the botanist, and writer on zoophytes, sponges, molluscs, and on annelides. Death of Sir Thomas Mitchell, the cosmographer, and of Hugh Miller, the geologist. Death of Parry, explorer and nautical astronomer.

1855. **Germany**—Rose discovers an economic mode of obtaining aluminium from cryolite. Death of Gauss, inventor of the magnetometer and the heliotrope; who proposed a general theory of magnetism, and invented the method of least squares.

1855. **France**—Death of Majendie, the physiologist and experimenter on living hospital patients; he died a natural death.

1855. **Switzerland**—Death of Sturm, who wrote on the compression of liquids, and resolving numerical equations.

1856. **Great Britain**—Bessemer's process of converting iron into mild steel is announced. Many new colors are used in dyed materials after this year.

1856. **Russia**—Manifesto of Alexander II., directed against interference with Naples, 2 September.

1856. **France**—Death of Karl Gerhardt (b. Strassburg, 1816), the writer on organic chemistry, essential oils, anhydrous acids and on amides.

1857. **Great Britain**—Coverley Jackson in vain warns the Government of the impending Mutiny. Indian Mutiny lasting till 1859. Divorce Act; from this time domestic crimes are made public. Death of John Kemble, archaologist and philologist of Anglo-Saxon. Death of Andrew Ure, organic chemist, geologist, and physicist, writer on materia medica.

1857. **Switzerland**—Conference at Paris about Neuchâtel. Prussia renounces political rights in it.

1857. **France**—Death of d'Oribigny, palaeontologist and zoologist of birds and aphalopods. Death of Cauchy, analytical mathematician, who extended the application of the integral calculus to a new range of problems. Death of Thénard, the chemist.

1858. **Great Britain**—Ending of the Chinese war with the Treaty of Tientsin. Bombardment of Jidda by Pullen on account of a massacre. Banks of limited liability formed. Blake's stone-crushing machine is introduced from the United States. Death of Robert Brown, botanist of Australasia, and proposer of a new natural botanic classification. Death of Turner Dawson, botanist and writer on Fuci. Death of John Forbes, who introduced auscultation as adopted by Laennec and Auenbrugger. Death of Sir William Reid, scientist, and writer on storms.

1858. **Italy**—Death of Carlo Lessona, author of many works on veterinary science.

1858. **Sweden**—Death of Keilhau, the Norwegian geologist and mineralogist.

1858. **Germany**—Death of Johann Muller, the comparative physiologist, writer on the organs of sight and of generation.

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1859. **Great Britain**—Large importations of paraffin or petroleum from Pennsylvania, the result chiefly of Drake's borings. Pneumatic despatch tubes are adopted for parcels in London, the invention of Medhurst, about 1810. Establishment of volunteer and shooting associations. Death of Lardner, the scientist.

1859. **Germany**—Death of Baron von Humboldt, botanist, physicist and ethnographer, who determined isothermal lines and the magnetic equator; hypsometric observer, writer on mediæval cosmography, and South American monuments.

1859. **France**—Italian campaign against Austria. Treaty of Zurich, 10 November.

1859. **Italy**—Revolt in Parma, Modena, Bologna, Tuscany, the Legations, etc.

1860. **Great Britain**—Cobden's disadvantageous commercial treaty with the S. Simonists and with France. Aluminium works are started at Battersea; it was a German invention of 1828, introduced in 1855. Improved main drainage of London is completed. Discord in India between the ruling legal officials and the military; they will not even dwell in the same part of a town or station. Death of Sir William P. Napier, the military historian.

1860. **Germany**—Bunsen and Kirchhoff show that potassium and sodium exist in the solar atmosphere.

1861. **Great Britain**—Repeal of the paper tax. Church rate bill. Death of the Prince Consort. The expected resignation of the queen in favor of her son does not take place. The southern seceding States of America trust to obtain English support for considerations of gain from the cotton trade. New Penal Code for India.

1861. **France**—Occupation of Syria. The Suez Canal is begun. Convention about Mexico.

1861. **Italy**—First national parliament, 18 February. The first king of modern Italy is proclaimed, 17 March. Papal intrigues.

1862. **Great Britain**—Sanad of nobility on the 153 Indian feudatories. Fenian plots at Clonmel. Balloon ascents of Coxwell and Glashier for scientific purposes.

1862. **Germany**—Death of Emil Harless, physiologist and comparative anatomist. Death of Uhland, first of the poetic German poets, lyric and dramatic; mythologist.

1862. **France**—Mexican war. War in Cochín China.

1862. **Italy**—Revolt of Garibaldi. Battle of Aspromonte; amnesty. Death of Strambio, who preserved Milan against cholera four times, and wrote on pathologic physiology.

1862. **Russia**—The Emperor Alexander II. decrees the abolition of serfdom in Russia.

1863. **Great Britain**—Year of speculation in Indian cotton. The hydro-carbon light invented by Bowditch is used at Wakefield. Nicholson discovers chrysianiline among refuse from magenta dye manufacture.

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1863. **France**—Death of Oudinot, writer on military subjects, specially on the use of cavalry.

1863. **Germany**—The Diet decrees Federal action against Denmark, and rejects English remonstrances on 22 October. The Prussian and Austrian armies invade Holstein, 23 December.

1864. **Great Britain**—Cession of the Ionian Islands to Greece. Bhutan war. Sympathy with Denmark. Rymer uses nitrous oxide gas in dentistry, a discovery of Horace Wells in 1845.

1864. **France**—Intervention between Austria and Prussia. Convention to evacuate Rome.

1864. **Germany**—Death of Heinrich Rose, analytical and pharmaceutical chemist.

1864. **Russia**—Polish revolt suppressed. Migration of Circassians, some arrive and settle in the Balkans. Death of Struve, astronomer and geodesist, who wrote on multiple stars.

1865. **Great Britain**—Fenian disturbances begin. Reduction of the heavy tea tax. A bishop is excommunicated for disbelief in the old Jewish Scriptures. Fourth visit of cholera, 1865–66. Death of Charles Waterton, the exploring zoologist of Guiana. Death of William Henry Smith, adm. physicist and astronomer. Death of the botanist, Sir W. Jackson Hooker, who explored the peaks of the Atlas range. Death of Paxton, designer of large greenhouses. Death of Sir John Richardson, the exploring zoologist and geologist.

1865. **Spain**—S. Domingo is relinquished. Sale of crown lands. Dismissal of Claret.

1865. **France**—Death of Mathieu, who first attempted meteorological forecasts.

1866. **Great Britain**—Reform league mobs. A revolt in Jaymaca is promptly subdued. The art collections at Sydenham are burnt. Suspension of the Bank Charter Act. Oliver Byrne invents dual logarithms and publishes his method of computation and tables.

1866. **Germany**—Prusso-Austrian war, 17 June to 1 August. Italian war, 18 June to 26 July.

1867. **Great Britain**—Abyssinian war. Dominion of Canada formed. Death of Faraday, the chemical discoverer, who discovered Faradic electricity and benzene, the basis of a series of dyes, besides other things.

1867. **France**—Abolition of imprisonment for debt. Year of many royal visits to Paris.

1867. **Austria**—The Hungarian constitution is revised. A second coronation is performed.

1867. **Germany**—The North German Confederation is constituted, 9 February.

1868. **Great Britain**—The Geneva convention is signed. Executions are made private.

1868. **France**—The army is greatly increased by the Bill of February.

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1868. **Spain**—Revolt and expulsion of the queen. Provisional government of Serrano.

1868. **Russia**—Hostilities against Bukhara. Sale of Alaska to the United States of America.

1869. **Great Britain**—The disestablishment of the Irish Church on 1 January, 1871, is now decreed. Act for preservation of birds in close season. Curtate logarithms are invented; tables of them are published later. Condensed formulæ for the computation of reduced lunar distances and other things are also made to suit computations with short curtate logarithms and yield exact results.

1869. **France**—Opening of the Suez Canal. Election riots. Congress about Greece at Paris.

1870. **Norway**—Valuable fishing-grounds are found near the Aasvar Islands, Arctic Circle.

1870. **Great Britain**—Irish Land Bill. Butt demands Irish Home Rule. Papal infallibility is decreed this year. The diamond rock-borer is adopted at Croesor by Beaumont.

1870. **France**—War plebiscite, 8 May. War declared against Prussia, 17 July; begins 30 July. Capitulation at Sedan, 2 September. German occupation, 15 September.

1870. **Spain**—Election of Amadeo as king, 16 November; he arrives 30 December.

1870. **Italy**—Papal Infallibility is decreed by a packed Council.

1871. **Great Britain**—Abolition of purchase in the army. Compulsory Schooling Bill. Acquisitions of Guinea coast colonies from the Netherlands. African explorations of Livingstone, a medical missionary.

1871. **Germany**—Terms made with France, 26 February. Elections for the first Reichsrath of United Germany, 3 March. Opening of the Old Catholic congress at München, 22 September. Compressed oil-gas is used on the Lower Silesian railway; it was an English invention, patented in 1792.

1871. **Italy**—A pension is offered to the Pope, 13 May. The government moves to Rome, 3 July.

1872. **Great Britain**—Genevan decision about the Alabama claims. Genevan decision about S. Juan. Food Adulteration Bill.

1872. **Germany**—Expulsion of all Jesuits, June.

1872. **Spain**—Revolts. Attempt to assassinate King Amadeo, 19 July.

1873. **Great Britain**—Domineering of the Liberal ministry. Arthur Rowbottom finds large beds of borax in South Carolina and in California.

1873. **France**—The evacuation of France by the Germans is complete, 13 September.

1873. **Spain**—Abdication of King Amadeo, 11 February. A republic is declared. Carlist war resumed.

1873. **Russia**—Territorial acquisitions from China.

1874. **Great Britain**—International postal union is arranged. Visit of the Tzar of Russia.

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1874. **Spain**—Serrano carries on war against the Carlists. Prince Alfonso is proclaimed king, 31 December.

1874. **Italy**—Seizure of Camorristi, September. Garibaldi refuses a sum of money, December.

1875. **Great Britain**—The Fiji Islands are colonised. Purchase of Suez Canal shares by the government. Death of Charles Lyell, the exploring geologist.

1875. **Germany**—Suppression of stipends of Romish clergy, April. The making of aniline dyes, an English invention, now becomes common. *See* 1863. Civil marriage is adopted, January.

1875. **France**—New constitution. De la Bastie, a glass-maker, invents toughened glass.

1876. **Great Britain**—African expedition of Cameron. Meetings about Turkish atrocities. Congress of Stambul. Law for crossed cheques and bankers' books.

1876. **Portugal**—Liberation of slaves in Portuguese colonies (not in Brazil).

1876. **Germany**—Bayreuth musical festival, 13 August.

1876. **Italy**—The 'Black book' discovery, June.

1877. **Great Britain**—The Transvaal republic annexes itself to Great Britain for safety from extinction by the Zulus. Death of Sir Henry Montgomery, who introduced deltaic irrigation in Southern British India from Tanjor. Famine in Ireland, 1877-80.

1877. **Germany**—The Liberal National party obtain a large majority in the Reichsrath.

1877. **Spain**—The Cuban insurrection is subdued.

1877. **Russia**—The Porte rejects the protocol of the Great Powers, 13 April. Russia declares war, 24 April. This war lasts till the forced treaty of San Stefano in 1878.

1878. **Great Britain**—Acquisition of the fiefdom of Cyprus under the treaty of Berlin, 4 June and 13 July.

1878. **Italy**—Death of Pío IX., last Pope with temporal power.

1878. **Russia**—Treaty of Berlin, 13 July, with the consent of Europe. Autonomy of Bulgaria and East Rumelia.

1879. **Great Britain**—Second Kabul war. Surrender of Sekukuni to Wolseley. John Hollway invents the process of perfect combustion of sulphides in ores.

1879. **Ottoman Empire**—Deposition of Ismail Pasha; Tewfik Pasha, his son, becomes Khedive.

1879. **Spain**—King Alfonso marries Maria Christina of Austria, November.

1880. **Great Britain**—County Galway is proclaimed a disturbed district. Irish disturbances begin again.

1880. **Russia**—Expulsion of all foreign Jews from S. Petersburg 30 April.

1880. **France**—Most of the canals have now been bought by the State, and are freed from toll; the process was gradual since 1853.

1881. **Great Britain**—Two detachments are defeated by the Transvaal Boers, who had revolted. The Transvaal republic

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separates with consent, 3 August. Pintsh's system of lighting with oil-gas is adopted in automatic beacons by the Clyde Trust Commissioners, afterwards also in lighthouses.

1881. **France**—Secession from the Anglo-French joint control over Egypt ; refusal to lose a man or spend a franc.

1881. **Rumania**—An independent kingdom under Prince Charles of Hohenzollern ; the Dobrudsha is annexed.

1881. **Russia**—Assassination of the Czar, the liberator of the serfs, through the plots of the Nihilists.

1882. **Great Britain**—The fleet is threatened by Egyptian insurgents, after some British subjects had been massacred. Occupation of Egypt. Cremation is now permitted. Year of speculation in electrical industries.

1882. **France**—Occupation of the Regency of Tunis. Italian diplomatic opposition.

1883. **Great Britain**—Officials are killed in Ireland. Dynamite explosions in London. Mass meetings of Englishmen in India against a proposition, (Ilbert Bill) to put Englishmen under native jurisdiction, made by an unpatriotic Viceroy.

1883. **France**—Military intervention in Madagascar, and war ; Loango burnt. A Parisian mob is allowed to insult the king of Spain.

1884. **Great Britain**—Defeats of the Mahdists. Attempt to withdraw some Egyptian garrisons from the Sudan.

1884. **France**—Annexations in Anam ; operations on the Red River. Blockade of China. The French now adopt the Right of Search.

1884. **Russia**—Occupation of Puli Khatun on the Kabul frontier, 1 November.

1885. **Great Britain**—Difficulties about Panjdah. War on the Red Sea littoral. The Burmese kill some British subjects. Accused persons may now defend themselves at law, and may give their own evidence. Lindborg's system of lighting with oil-gas is used at Stoneness lighthouse.

1885. **Ottoman Empire**—Threatened naval attack of the Greeks. European intervention.

1885. **Bulgaria**—Servian invasion and partial conquest. Crushing defeat by Prince Alexander of Battenberg. Austrian intervention saves Servia.

1886. **Great Britain**—Severe want. Riots in London and Westminster. First abolition of official bribing of evidence. Irish proposal to divide the Imperial Parliament.

1886. **France**—Maurice de Thierry invents a new absorption spectroscope, for observing the absorption spectrum of a fluid to the depth of 10 mètres, and then detecting minute portions of substances. M. Gautier invents a new mercurial bath with a double basin for use on artificial horizon, free from vibrations ; for practical astronomic purposes.

1888. **Sweden**—Invention of a new glass, having boron and

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phosphorus as constituents, possessing very high refractive power. Experiments on vapor density of chromic chloride by Nilson and Petersson.

1888. **Great Britain**—Experiments of T. Turner and of R. A. Hadfield on the effect of silicon and of manganese on iron and steel in ingots. Bell and Tainter invent the graphophone, dispensing with electricity, and replacing the phonograph. Keep's process of adding aluminium to copper, to wrought iron, and to cast iron, is adopted at Stoke-on-Trent. Cyclone-pulverisers are used in ore reduction. A very perfect clock-driven telescope is made by Howard Grubb at Dublin. Water-gas, costing fivepence per thousand cubic feet, is used at Leeds, both for lighting and foundry work. There are now 2300 art and science schools in the United Kingdom.

1888. **Germany**—Seamless tubes are rolled from bars with conoidal rollers under the Mannesmann process. Otto Brunn purifies hydrogen from arsenical and antimonial traces.

1888. **France**—Raoult's relation between the molecular weight of the substance, with the freezing-point of its solution, and amount, is now widely used. Frémy and Verneuil make artificial rubies.

1889. **Great Britain**—Woodbury invents a hot-air engine said to consume only two pounds of coal per horse-power. Discoveries about the tenacity and elasticity of quartz fibres by C. V. Boys. The Linotype, or type-mould setting machine of Mergenthaler, comes into use.

1889. **France**—The hydraulic railway of Barre, with hydraulic propulsion, and a water-film on the rail, is now used; it is an improvement on that of Girard invented in 1864.

1890. **Great Britain**—Treaties with Germany, France and Portugal about African limits of influence. Strikes and intimidation by laborers. An immense refracting lens is made by Grubb. L. Hargrave invents a flying machine at Sydney.

1890. **Netherlands**—The Government offers a prospective reward for a suitable method of preserving packets of salt coming from its Asiatic colonies.

1890. **France**—Lion forms a photometer based on the decomposition of iodide of nitrogen. Séguéy adapts Crooke's radiometer to angular photometry.

1890. **Italy**—Edict for suppressing patent medicines of unknown ingredients.

DISCOVERY IN SPECIAL BRANCHES.

Archæologic Discoveries.

1802-18. The discovery of the Elgin marbles, and their preservation from the Turk and from wreck.

1840. Antiquities of Nineveh and Babylon unearthed by Layard.

1872-73. Antiquities of Pergamos and of Corinth discovered by Schliemann.

1888. Mammoth remains, together with flint implements and a flint spear-head, are found in loam, 13 feet below the surface at Southall.

1889. Prestwich discovers presumed pre-glacial flint implements at Ightham in Kent.

1890. Yadrintzeff discovers the ruins of an ancient Mughal capital town at Kara Balgassum, on the left bank of the Orkhon, 30 miles below the confluence of the Urtu-Tamir, in N. lat. $47^{\circ} 15'$, long. E. of Greenwich $102^{\circ} 20' 15''$.

Naturalistic Notes.

1800-10. Probable entire disappearance of the *Moa*.

1824. An entire fossilised mammoth is found at Ilford at a depth of 16 feet, May 1.

1827. Many fossilised animals, hyænas, &c., are found at Boughton quarries, Maidstone.

1832. Many fossilised animals, rhinoceros, hyæna, &c., are found at the Cefn caves, Cyffredau, Denbighshire.

1850 c. The bones and eggs of the *Epiornis maximus* are found in Madagascar. It is supposed that this was the great roc seen at Makdashbu, Somali coast, by the companions of Marco Polo.

1860 c. G. F. Bennett dis-

covers the *Megalania prisca*, an armoured lizard 20 feet long, in the drift-beds of King's Creek, Condamine River, Australia.

1872 c. Discovery of an immense living iguana or true lizard, *Mato reale maximus*, nearly black, and more than 20 feet long, by L. Jackson, near Palma picada, Venezuela.

1878. Discoveries of iguanodon and other fossils near Tournay, by Dollo.

1881. Przevalsky discovers a horse of new variety in the deserts near the Altai range.

1883. Discoveries of bacilli or some specific organisms of disease by Koch.

1888. The old water level of the Caspian Sea, 235 feet above the present water edge, is traced by Netchayeff of Kazan.

1889. Observations of Dr. C. Q. Jackson on the bacillus of leprosy.

Chemical Separations, &c.

Metals.

1801. Columbium (Hatchell).

1802. Pelopium from columbite (Rose).

1803. Cerium (Berzelius).

1803. Rhodium (Wollaston).

1803. Palladium (Wollaston).

1803. Iridium (Tennant).

1803. Osmium (Tennant).

1807. Boron (Davy).

1807. Potassium (Davy).

1808. Calcium (Davy).

1808. Sodium (Davy).

1808. Barium (Davy).

1817. Cadmium (Strohmeyer).

1817. Lithium (Arfwedson).

1824. Silicon (Berzelius).

1828. Aluminium (Wohler).

Discovery in Special Branches

- 1828. Glucinium (Wohler).
- 1829. Thorium (Beizelius).
- 1830. Vanadium (Sefström).
- 1839. Lanthanum (Mosander).
- 1840. Terbium (Mosander).
- 1841. Didymium (Mosander).
- 1841. Erbium (Mosander).
- 1843. Ruthenium (Klaus).
- 1845. Niobium (Rose).
- 1861. Thallium (Crookes).
- 1861. Cesium (Bunsen).
- 1863. Ilnenium (Hermann).
- 1863. Indium (Richter).
- 1863. Norum (Svanberg).
- 1863. Tantalum (Eckeberg).
- 1863. Wassium (Bake).
- 1875. Gallium (Boisbaudran).
- 1877. Neptunium (Hermann).
- 1878. Philippium (Delafontaine).
- 1879. Mosandrium (L. Smith.)

Other Substances.

1800-28. Separation of the protoxide of nitrogen. Nitrous oxide gas is discovered. The properties of chlorine are discovered. The existence of acids without oxygen. Electric decomposition of earths (Davy).

1800-46. The separation of arsenic by the deposition of its fumes (Marsh).

1804 c. The extraction of the nitrogenous elements of meat (Berthollet).

1810. Artificial ice made with sulphuric acid (Leslie).

1813. Iodine separated (De Courtois).

1818. Sulphuric ether, as an anæsthetic (Faraday).

1820. Nux vomica, strychnia (Pelletier and Caventon).

1820. Quinine (Pelletier and Caventon).

1820. The use of chloride of lime as a disinfectant in sewers, for embalming, and for safety in preparing animal cord (Labarraque).

1825. Benzene discovered (Faraday).

1826. Bromine discovered (Baldard).

1826. Aniline separated from indigo (Unverdorben).

1828. Wohler makes artificial urea.

1829. Artificial ultramarine and guaracine is made in France.

1831. Alizarine separated from madder by Robiquet.

1832. Anthracene separated from petroleum by Dumas.

1832. Chlorate of potash is used in matches.

1832. Chloroform discovered (Soubeyran).

1834. Carboic acid or Phenyl alcohol (Runga).

1845. Nitrous oxide, anæsthetic (H. Wells).

1847. Nitroglycerine discovered (Sobrero).

1847. Benzene isolated from coal tar (Mansfield).

1857. Artificial ice made with ether and salt (Harrison).

1858. Permanganate of potash, used to destroy organic matter.

1860. Manganese, recovery of chlorine in bleaching paper, &c.

1861. Kirchhoff and Bunsen adopt 'Spectrum analysis.'

1861. Thomas Graham adopts dialysis; and later atmolysis.

1863. Chrysaniline (Nicholson).

1863. Paranaline (Hofmann).

1863. Xenanaline (Hofmann).

1868. Alizarine (Graebe).

1868. (?) Magnetic carbide used to destroy organisms (Spencer).

1873. Borax used to destroy organic matter, cleanse woollens, &c. (Rowbottom).

1880. Indigo reduced (Baeyer).

1880. Hannay makes crystals of carbon, true diamonds. Grimaux and Adam make citric acid from glycerine.

1881. Croceine group of dyes.

1885. Saccharin separated (Fahlenberg).

1886. D. N. Witt discovers a new class of dyes, termed Eurhodine dyes.

Discovery in Special Branches

1886. Humbert and Henry propose an economic mode of producing hydrogen through the action of superheated steam on white-hot coke.

1887. W. B. Middleton adopts a process of welding steel with silicate of soda.

1887. An improved amalgam process is proposed for extracting a high percentage of gold. A new chlorine process of Newbery Vautin for separating gold is adopted.

1887. Parnell and Simpson employ a new combined 'ammonia' method of forming carbonate of soda.

1888. Discovery of a large series of fast dyes for cotton, not requiring any mordant; these are sulphonic compounds of azo-compounds from Diamines.

1888. M. Moissan isolates fluorine, through electrolytic action on hydrofluoric acid at a very low temperature.

1888. The Oldbury process, combining the Castner and Deville processes, reduces the cost of producing aluminium and sodium to a quarter.

1888. Fluorine gas perfectly isolated.

1889. Creolin, of the ammonine group, a disinfectant of water.

1889. Hannay adopts a process of making a white lead paint direct from sulphide of lead ore.

1890. Candles diffusing bromine vapors and iodine vapors are invented for germicide and throat healing purposes. Lewkowitsh scents water-gas with thioacetone and acrolein to detect leakage.

Applications of Steam.

1801. The first working steam-boat on the Thames (perhaps like that on the Clyde Canal) (Symington).

1802. High-pressure steam-engine (Trevithick and Vivian).

1803. Steam-carriage for roads (Trevithick and Vivian).

1803. Steam-gun experiments (an old principle of Archimedes) (Murdock).

1804. Double cylinder engine improved (Woolf).

1804. Locomotive for a Welsh railway (Trevithick).

1810. Rotative steam-engine (Wittv).

1811. Rack-wheeled locomotive (Blenkinsop).

1812. The 'Comet' steamer on the Clyde (Bell).

1813. Rotative boring machine at Plymouth (Trevithick).

1813. Alternating-motion compound locomotive (Brunton).

1814. Steam-printing of a newspaper (König).

1818. Transatlantic steamer 'Savannah.'

1821. Locomotive coach in Dublin (Griffith).

1821. Coasting steamers used in the North Sea and in the English Channel.

1824. Large steam-gun (Perkins).

1825. Darlington and Stockton passenger railway.

1827. Ocean steamer, 'Curaçao,' built on the Clyde.

1830. The first disc-engine patented (Dakeyne).

1830. Steam fire-engine (Brathwaite).

1830. Liverpool and Manchester railway is first worked with steam power.

1832. Steam-plough (Heathcote).

1836. Screw propeller for ships (F. P. Smith).

1836. Nürnberg and Furth railway.

1842. Steam-hammer (Nasmyth).

1845. Screw-steamers adopted in the Navy.

1854. Steam-plough at Lincoln (Fowler).

1857. Launch of the 'Great Eastern.'

Discovery in Special Branches

1860. Heavy shot-proof steamers (Cole).

Applications of Electricity.

1800. The voltaic pile, and discovery of voltaic electricity, finally by Alessandro Volta.

1800. Sir Humphry Davy produces an electric light with carbon points.

1802. The deviation of the magnetic needle under the influence of a galvanic current is discovered (Romagnosi).

1802. The same discovery is made by Oersted, the result is termed electro-magnetism (Oersted).

1802. First attempt to sustain electric light in a vacuum (Bunsen).

1804. Libes discovers the electricity of contact by means of silk, the basis of the Dry Pile (Libes).

1811. The voltaic battery is applied in telegraphy by Sommering of München (Sommering).

1816. Great improvement in telegraphy (Sir H. Popham).

1817. Researches in terrestrial magnetism by Hansteen of Christiania (*see* 1688).

1820. Application of Oersted's electric-magnetism to telegraphy (Ampère).

1820. A new galvanometer is invented, and a perpetual electro-motor is described by Zamboni.

1823. Electric ignition of mining charges (Harris).

Before 1835. The thermo-multiplier is invented, also the metalloscrome, and the double electric needle, also the induction theory is discovered (Nobili).

Before 1836. The magnetizing force of the violet ray of the solar spectrum is discovered (Morichini).

1837. The electro-magnetic telegraph is first patented (Cook and Wheatstone).

1837 c. Morse's self-recording instrument is invented in America.

1837. Electro-plating at S. Petersburg (Jacobi).

1837. Electro-plating at Liverpool (Spencer).

Before 1840. A universal galvanometer invented (Majocchi).

1840. Electro-tinting is applied to engraving, first in 1840, next in 1842 (E. Palmer).

1848. Electric lamp patented (Greener and Staite).

1847. Magneto-electric machine (Sturgeon).

1848. Magneto-electric telegraph (Henley).

1849. Magnetic clock, American (Locke).

1850. Electric lamp (Allman).

1851. Electro-dynamic coil (Ruhmkorff).

1851. Submarine cable works from Dover to Calais.

1854. The electric loom of Turin (Bonelli).

1855. Reymond obtains an electric current from muscular movement.

1858. Electric light used at new Westminster bridge.

1859. Leon Scott indicates the principles of the phonograph, as far as the invention is concerned.

1859. Electric light at S. Foreland lighthouse.

1861. The telephone is invented (Reuss).

1861. Submarine cable, Malta to Alexandria.

1866. Improvement of the telephone (Bell and Gray).

1866. Atlantic telegraph cable is first laid.

1867. Death of Faraday, the discoverer of Faradic electricity and of other matters.

1870. Improvement of the telephone (Varley).

1873. Third Atlantic cable is laid.

1876. The Jablochoff electric candle (Jablochoff).

1880. The incandescent electric lamp (Swan).

1881. Small electric motors, and electric railway of Siemens.

Discovery in Special Branches

1882. A boat is propelled by electric accumulators. Many new secondary batteries are invented in England.

1883. Portrush electric railway in Londonderry.

1884. A balloon, moved and steered with a dynamo-electric machine, is designed and used by Renard, perhaps in calm weather.

1886. The new primary batteries of Maquay and of Upward are proposed.

1888. The hydrophone of Barraré is used at Brest successfully for hearing sounds under water for two miles.

1888. Webster adopts electric purification of sewage.

1888. Von Bernardos proposes a new mode of electric welding, as a substitute for that of Elihu Thompson.

1888. The 'Hermite' electro-bleaching process, now invented, employs a low tension dynamo for electrolysis the magnesium chloride solution.

1890. The domestic dynamos of H. Austin of Armley, near Leeds, producing from 50 to 1000 watts, with a winding armature.

Explosives and Ignition.

1807. Percussive ignition in firearms with detonating powder at Aberdeen (Forsyth).

1823. Electric ignition of mining charges (Harris).

1829. Fulminating silver priming introduced (Shaw).

1831. The safety fuze is invented by Bickford.

1833. Chlorate of potash is used in matches.

1834. Percussive ignition of mining charges (Pischel).

1848. Gun-cotton exhibited at Southampton (Schonbein).

1847. Nitro-glycerine discovered (Sobrero).

1850. Low-tension fuzes for igniting blasting charges in mines.

1863. Nitro-glycerine used in blasting in England.

1867. Dynamite invented at Hamburg (Nobel).

1874. Mica powder is patented (Mowbray).

1885. Bellite, a compound of dinitro-benzole, nitrate of ammonium, and saltpetre, that explodes only under detonation (Lamm).

1885. Rackarock, a mixture of chlorate of potash and nitrobenzole invented by Rand.

1887. Melinite is adopted in France.

1889. Smokeless gunpowder is invented in France.

1890. Trial of Giffard's rifle in London; in which he used liquefied carbonic acid, and fired 300 shots without loading again. There was no recoil or smoke, and very little noise. An advantage of smallness and lightness of the weapon, and of absence of corrosion, was also claimed as due to his method.

1890. Carbonite is used by miners in South Wales, it explodes only under detonation, and is unharmed by storage. Edward Liebert of Berlin invents a mixed dynamite that does not freeze to 35° below zero.

EXPLORATION AND SETTLEMENT.

African Voyages.

1801. Trotter and Somerville to Lattakoo, beyond the Orange River.

1807. Second expedition of Mungo Park in West Africa to Bussa, on the Niger.

Before 1814. Travels of Domingo Badia y Leblich (Ali Bey) in Asia and Africa.

1817. First expedition of Belzoni to Egypt in 1815, opening of the Great Pyramid, and of some royal tombs at Thebes; in 1817 the temple of Ipsambul at the second cataract; also to Berenice, and to Zubara and the oasis of Ammon.

1817. Campbell arrives at the Panietta.

1819. Lyon and Ritchie explore Fezzan.

Before 1820. Explorations of Nathaniel Pearce in Abyssinia and Tigre.

1820 c. Travels of Segato the anatomist in Senaar, where he discovered the colourless and flexible mode of petrifying corpses in their natural color.

1822-25. Trans-Sahara exploration of Denham Clapperton.

1826. Trans-Sahara exploration of Laing.

1828 c. African travels of Renand Caillé, who went to Timbaktu.

1830. Niger exploration of Lauder.

1831-59. Exploration of Nubia and the regions of the Upper Nile by Brun Rollet (Khawja Yaküb), to 4° N. latitude.

1832-57. Travels of Macgregor Laird in West Africa.

1845. Duncan arrives at Adafudia.

1849. Trans-Kalahari expedition of Livingstone.

1855-56. Zambesi expedition of Livingstone.

1855-59. Travels of Paul du Chaillu in Equatorial Africa.

1857-58. Burton and Speke's expedition to Uvira and Lake Ukerewe.

1860. Travels of Grant and Speke to Lake Kilimanjaro.

1860-62. Nile expedition of Speke.

1861. Livingstone arrives at Nyassa.

1865. Samuel Baker discovers the Albert Nyanza.

1865. Second African expedition of Paul du Chaillu in the country of the Dwarfs.

1871-72. African travels of Stanley—first to Ujiji on Lake Tanganyika.

1871-75. Nachtigal's exploration in West Africa.

1876. Cameron's Trans-African exploration.

1883-86. Expedition of Aubrey to the Shoa Galla and Somali lands on a scientific mission.

1885. Emin Pasha's expedition.

1885. Dr. Peters explores the backlands of Zanzibar towards Lake Tanganyika.

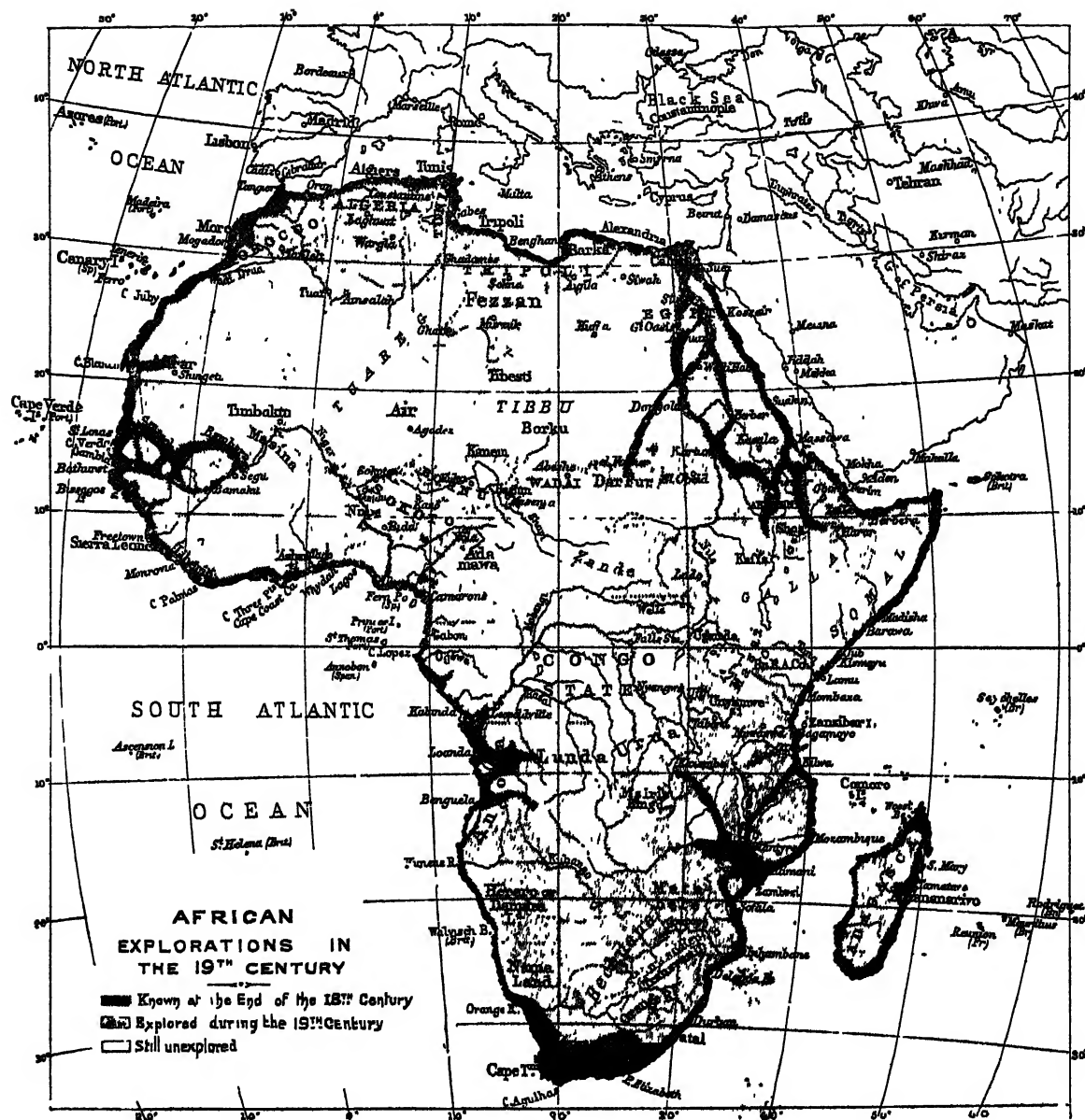
1885. Expedition of Pinto.

1886. South African expedition of Kerr to Lake Nyassa.

1886-89. Stanley's later expedition.

1888. Failure of the English relief expedition of Bartelot.

1890. Withdrawal of Emin by Stanley's expedition.



Exploration and Settlement

Africa.

Senegal, &c.

1809. The English take the French settlements.

1814. They restore them to the French.

1883. Expedition of Desbordes.

1890. Anglo-French treaty regarding the French sphere of influence.

Sierra Leone and Gambia.

1800. Third negro settlement of Maroons from Jaymaca.

1807. Freed slaves are landed.

1808. Sierra Leone is termed a British Colony.

1816. Bathurst settlement is formed.

1818. I. de Los is joined to the settlement.

1819. Fourth negro settlement of a disbanded regiment.

1824. The Ashantis kill Governor Macarthy.

1843. Separation of Gambia from Sierra Leone.

1862. Acquisition of Sherboro and some coast land.

1866. Reconstitution of West African settlements.

1882. Acquisition of coast as far as Mannah.

Liberia.

1820. First negro settlement at I. Sherboro.

1822. Removal of the settlement, and founding of Monrovia, the capital.

1848. Independence acknowledged.

Gold Coast Colony.

1881. The forts and trade stations of the West African Company are transferred to the Crown, and annexed by Sierra Leone Government.

1872. The Netherlands cedes its settlements to Great Britain.

1873-4. Ashanti invasion and war.

1874. Separation of the Gold Coast colony.

Benin, Calabar, Biafra, &c.

Old trading posts on the coast chiefly under English control.

1819-32. Sokoto becomes powerful.

1851. English blockade to restrain slave piracy.

1861. Cession of Lagos, Badagry, &c. by Docemo.

1881. The Germans declare the English stations of the Cameroons not permanently settled under an annual occupation for four months.

1881. Occupation of the Cameroons and Calabar by Germany; mortality of Germans.

1884-5. The Royal Niger Company acquires rights, privileges and lands of Sokoto.

1890. Entire cession of Sokoto to British suzerainty.

Congo.

1816. Explorations of Tuckey.

1877. Explorations of Stanley.

1880 (?). Surrender of English claims in favor of Portugal.

1880. Formation of an International State under German auspices.

1883. The French burn Loango.

Angola, Benguela, and Damaraland.

1884. German annexation of the coast territories, down to Walfisch Bay.

Namagualand.

1837. Explorations by Alexander.

Damaraland.

1885. German occupation and annexation.

1888-89. German withdrawal and second occupation.

Cape Colony.

1802. Restoration of Cape Town to Holland.

Exploration and Settlement

1808. Cape Town taken again, by Popham and Baird.

1811. Kaffir attacks.

1814. Formal cession of Cape Town to England.

1819. Second English settlement.

1820-46. Kaffir wars.

1844. Duncan and Ruxton explorations.

1844. Annexation of Natal.

1848. Kaffir war and annexation of the Orange River settlements.

1850-53. Kaffir war.

1853. Constitution formed of the Cape Colony.

1854. Separation of the Orange River settlement; and independence of the Transvaal.

1856. Separation of Natal.

1866. British Kaffraria incorporated.

1868. Basutoland incorporated.

1871. Griqualand West ceded by the Griquas.

1875. Fingoland and Nomansland acquired.

1875. Separation of Griqualand West.

1877. Annexation of the Transvaal.

1880. Basuto war.

1881. Separation of the Transvaal.

Natal.

1824. First English settlement.

1836. Settlement of Huguenot Boers.

1839. The Boers renounce British allegiance.

1842-44. Natal war, expulsion of the Boers; and annexation of Natal to Cape Colony.

1856. Separation of Natal from the Cape Colony.

Transvaal.

1840. First Boer settlement.

1844. Second Boer settlement.

1854. Independent of the Cape Colony.

1876. Kaffir war, likely to end in extermination of the Boers.

1877. British intervention and annexation.

1879. Zulu war, subjugation of Cetewayo.

1881. Revolt of the Boers, and independence.

Mozambique.

1875. Under Portuguese governors. The British take some forts and cede them to Zanzibar.

1890. Anglo-Portuguese treaty.

Zanzibar.

1856. Explorations of Burton and discovery of Lake Tanganyika.

1873. Treaty for abolition of slave-trade.

1874. Fort Mombazique is taken and annexed.

1884. German intervention.

1888. German difficulties.

1890. British treaties with the Germans and French.

Madagascar.

1811. Wars between the English and French settlers.

1817-20-23. Treaties with England.

1825. Radama I. reduces Fort Dauphin.

1829. French attack; treaty with the Hovas.

1845. Expulsion of Europeans. The Europeans reduce Tamatave.

1862. Treaties with France and with England.

1865. Treaty with England.

1877. Emancipation of slaves.

1883. The French bombard Majunga and Tamatave.

1885. Hova treaty with the French.

1890. French treaty with England about recognition.

Mascaregue, or Bourbon.

1810. British occupation.

1815. Restoration to France.

Exploration and Settlement

Cerne, or Mauritius.

1810. British occupation.
1815. Retained under treaty.

North Asia.

Siberia and Corea.

1839. Slaughter of Christians and missionaries in the Corea.
1866. Persecution of French missionaries in the Corea.
1866. The Coreans defeat a French naval attack.
1871. United States successful naval attack in the Corea.
1876. Independence of the Corea allowed by Japan and China.
1886. Siberian expedition of the zoologists, Baron von Toll and Dr. Bange.

Tibet.

- 1844-46. Travels of the missionaries Evarist Huc and Gabet in Tibet and China.
1884-86. Expedition of Potanin in China, Central Asia and Tibet.
1887. Expedition of A. W. Carey to northern Tibet and Chinese Turkestan.
1888. Central Asiatic journey of Y. E. Younghusband, from Peking to Kashmir.
1888. Death of the zoologist, Prijevalsky, on his fifth great expedition to Tibet.

Arabia.

- 1800-57. Perim occupied.
1830. Red Sea discoveries of Waghorn.
1839. Aden purchased.
1845. Red Sea route to India opened.
1851. First expedition of Richard Burton on a pilgrimage to Mekka Sharif.

Colonial Settlements and Acquisitions.

Asiatic.

1800. Balari, Kadapa, and Tanjur acquired by the English.
1801. North-west Provinces from Audh.
1801. The Karnatak (South India) administered.
1803. Bandalkand, Kattak, Dihli, and Agrah acquired.
1813. Parts of Java acquired.
1814-16. Kochi and Malabar possessions of Holland acquired by exchange for Banca.
1815. Gogra-Ganges Duab (from Nipál).
1816. Ceylon recovered.
1816. Cession of parts of Java.
1818. Himalayan peaks explored.
1818. Puna, and some Maratha territory.
1819. The island Singapur purchased.
1824. Arakan and Tennasserim.
1824. Cession of Bencoolen to Holland.
1833. Kachár and Assam.
1833. Indian and Chinese commerce opened to all nations by English courtesy.
1834. Kurg.
1841. Karnúl — the Bhután Duars.
1843. Cis-Satlaj States—Sind.
1845. Jhalandhar Duab.
1845. Labuan acquired.
1848. The Panjáb occupied.
1851. Penang, Malacca, and Singapur reconstituted.
1853. Pegu, Kachár, and Barár.
1854. Nagpur and Jhansi.
1856. Audh direct rule.
1875. Fiji Islands (Pacific) acquired.
1885-86. Exploration in south-west China to the bounds of Siam, by F. S. A. Bourne.
1886. Upper Burma annexed.

Exploration and Settlement

1888. J. Macarthy finishes a survey in Thai (Siam).

1888. Surveys in the southern Shan States by Jackson.

1889. Exploration of R. G. Woodthorpe about the sources of the Chindwin, an affluent of the Irawadi.

Colonial Settlements and Discoveries.

Australian.

1800. Auckland Islands discovered.

1817-22. Expeditions of King.

1818. Blue Mountains discovered.

1818. Macquarrie River traced.

1824. Expeditions of Hovell and Hume.

1828-30. Expedition of Sturt; Swan River exploration.

1831. Peel and Darling rivers discovered.

1831-36. Expedition of Mitchell.

1834. New South Wales settled.

1836. South Australia settled.

1836. Adelaide made the capital.

1837. Melbourne — Victoria founded.

1837-39. Expedition of Grey.

1838. North Australia settled.

1840. Settlements in New Zealand.

1840-41. Expedition of Eyre.

1841. Gipps Land explored.

1843. Landor and Lefray explore West Australia.

1845. Sturt's Trans-Australian expedition.

1846. Expeditions of Leichhardt, Mitchell, and Gregory. New Zealand recolonised.

1848-49. Expeditions of Roe and of Kennedy.

1851. Gold discovered in the Bathurst Mountains.

1853. French settlement in New Caledonia.

1855-56. Gregory explores the Victoria River.

1858-62. Stuart's five expeditions.

1861. Explorations of Robert O'Hara Burke in Central Australia from the Cooper river.

1876. Willshire explores the Daly and Victoria rivers.

1884. New South Wales sends a contingent to the war in the Sudan, organised by W. B. Dalley, Chief Secretary to the Ministry of New South Wales.

1887. German exploration of Papuan rivers by Admiral von Schlunitz. Exploration of T. F. Bevan in Papua.

1889. Exploration of Papuan hill ranges by Dr. H. Zoller.

North America.

Greenland.

1822. Exploration of Scoresby.

1829-31. Exploration of Graab.

Newfoundland and Labrador.

1832. Representative government established, including Labrador.

1859. Journeys of R. F. Holme in the interior of Labrador.

Canadian Dominion.

1839. Union of Upper and Lower Canada.

1867. Union with Nova Scotia, C. Breton Island, and New Brunswick.

1868. Union of Hudson Bay territories.

1871. Union with British Columbia.

1873. Union with Prince Edward's Island.

Exploration and Settlement

British Columbia and Vancouver I.
(the New Albion of Drake).

1806. First permanent settlement.

1850. Gold is found in Queen Charlotte Island.

1858. Gold discoveries in 1853, also in 1858.

1860. Silver is discovered.

1871. Incorporation with Dominion of Canada.

Hudson Bay Territory.

1821. Union of the two trading companies.

1868. Incorporation with Dominion of Canada.

United States.

1803. Purchase of Louisiana territories.

1814. The Maine boundary is disputed.

1820. Acquisition of Florida territories.

1841. Exploration of California by U. S. explorers.

1846. The Oregon boundary is disputed.

1848. Acquisition of New Mexico, Upper California, and Oregon.

1850. Utah and New Mexico annexed.

1854. Purchase of the Galapagos Islands.

1860-65. Secession war of Southern States.

1867. Purchase of Alaska.

1872. S. Juan arbitration by Germany.

1878. Chinese immigration difficulties.

1881. Fortune Bay fishery dispute.

1890. Behring Sea fishery dispute.

Mexique.

1821. Independence declared by Iturbide.

1821. Revolt of all Guatemala. Costa Rica, S. Salvador, and Panama join Mexico.

1823. California also revolts.

1823. Separation of Costa Rica and S. Salvador.

1833. Second revolt of California and Texas.

1838-9. French war.

1845-48. War against the United States.

1845. Texas becomes independent.

1848. New Mexico and Upper California lost.

1861-67. European intervention and withdrawal.

Central America.

1829. Confederation of Central America formed, including Guatemala, Costa Rica, and S. Salvador.

1839. Honduras secedes from Central America.

1846. Dissolution of the Confederation of Central America into small States.

1855-57. Filibustering of Walker in Nicaragua.

1859. Cession of the Bay Islands to Honduras.

1860. Mosquito territory ceded to Nicaragua.

1863. Wars of the Central American States.

1872-85. Wars in the Central American States.

Antilles and Carib Islands.

1801. The negroes of Hayti declare independence.

1802. Subjugation of Western Hayti by the French.

1802. Treaty of Amiens, Madania is restored to France, Trinidad is ceded to England.

1802. Revolt of the negroes of Domenica.

1803. Second revolt of Hayti, and expulsion of the French.

1807. English abolition of the slave-trade.

1809-10. The English take Madania and Guadalupe.

1814. Treaty of Madrid affecting

Exploration and Settlement

Mosquito territory ; Eastern Hayti is ceded to Spain.

1814. Guadalupe and Madania are restored.

1820. Revolt of Puerto Rico.

1822. Eastern Hayti declares independence.

1823. The Spaniards subdue Puerto Rico.

1825. The independence of Western Hayti is recognised by France.

1831. Revolt of the negroes of Jaymaca.

1833. Slave rebellion in Madania.

1834. English Slave Emancipation Act.

1848. Slavery abolished in Madania and Guadalupe.

1849-50. Soulouque rules Hayti.

1850-51. Filibustering of Lopez in Cuba.

1861. Eastern Hayti recovered by Spain.

1863-65. Revolt of Eastern Hayti against Spain ; the Spaniards relinquish the island.

1865-66. Negro riots in Jaymaca.

1873. Slavery abolished in Puerto Rico.

South America.

Colombia.

1810-12. Revolt of Venezuela, New Granada, and Quito against Spain.

1819. Confederation of Colombia formed under Bolivar. Panama joins in 1821.

1831. Venezuela separates finally.

1831. Quito (Ecuador) separates.

Guiana.

1802. Treaty of Amiens, restorations to Holland.

1814. Treaty of London, restorations to Holland and France. Great Britain retains a part.

1831. Formation of British

Guiana out of Berbice, Demerara, and Essequibo.

1834. English abolition of slavery.

1838. Abolition of old apprenticeship.

1863. Abolition of slavery in Surinam.

Brazil.

1808. The Portuguese court moves to Brazil.

1815. Joam forms a Brazilian kingdom.

1821. Revolutions in Pará, Bahia, Pernambuco, and Rio de Janeiro.

1822. Independence of Brazil under Dom Pedro, the Portuguese Regent.

1825. Acknowledgment of the independence of Brazil by Portugal.

Peru.

1821. Declaration of independence.

1824. Final defeat of the Spaniards, securing independence.

Bolivia.

1816. Declaration of independence of all the provinces of La Plata.

1824. Final defeat of the Spaniards.

1825. Formation of the republic of Bolivia.

1883. Chilian war 1879-83 ; cession made.

Chile.

1810. First declaration of independence.

1814. Recovery of Chile by the Spaniards.

1818. Second declaration of independence.

1833. Formation of the constitution.

1844. Spain admits the independence.

La Plata.

1810. Repudiation of Joseph Buonaparte and formation of a local government.

Exploration and Settlement

1816. Declaration of independence.

1821. Final defeat of the Spaniards.

1827-28. Attacks of the Brazilians.

1834. Formation of the Argentine Confederation.

1853. Secession of Buenos Ayres.

Paraguay.

1810. Revolt against the Spaniards.

1811. Formation of the independent republic.

Uruguay.

1813. Declaration of independence.

1828. Brazil admits the independence.

Buenos Ayres.

1834. Part of the Argentine Confederation.

1853. Secession of Buenos Ayres from La Plata.

1859-60. Temporary union with La Plata.

1865-74. Unions and disruptions.

Patagonia.

1843-54. Various settlements of Chilenos.

1861. Division of Patagonia between Chile and La Plata, by treaty.

Falkland Islands.

1820-44. Various English settlements.

1874. English settlement reformed.

Arctic Explorations.

1815. Explorations of von Kotzebue in search of a North-East Passage.

1815. Later expedition of Adam Krusenstern, Russian admiral, to find a north-eastern passage from Archangel to America; and by Behring's strait.

1819. Parry discovers Barrow Straits.

1835. Exploration and discoveries of Back.

1845. Expedition of Franklin.

1853. Creswell discovers the North-West Passage.

1876. Nares arrives at 83° N. latitude.

Several expeditions of Sir John Ross. (The expeditions are numerous, 40 or 50.)

Antarctic Explorations.

1815. Explorations of von Kotzebue.

1822. Exploration of Weddell.

1831-32. Discoveries of Graham.

1839. Freeman and Balleny's discoveries.

1840. D'Urville discovers Addie-land.

1841. Ross discovers Victoria land.

Several expeditions of Sir James C. Ross.

CONCLUDING REMARKS ON GENERAL DEVELOPMENT.

As it may be some help to the reader to indicate the drift of progress in science and development throughout the Ten Centuries collectively, and to assist him in perusing the foregoing record and account of so long a period, a few concluding remarks are permissible.

All science, progress, and skill of every sort, was originally Indian, due to slow developments made by Aryan races, Brahmans, Rajputs, and *proper* Hindus. The same generalisation also applied to religion, philosophy, and law. Thence it spread to Aryan Persia, and Chaldæa; to Egypt and China; afterwards to Asia Minor and the Greeks. The Greeks had one Indian introduction at the period of the Indian Dionysos, with his panther and his wine; but in the period of their philosophic development many of their leading men visited India, and brought back knowledge of astronomy, medicine, mathematics, and other things; thus all Greek science was of Indian origin, either direct or through the Egyptians and Persians.

The Roman developments, known in former Roman provinces, may be termed Greek, as, roughly speaking, they were so by origin. The skilled craftsmen, statuary, freedmen, and mass of the servile population of Magna Græcia, and other parts of Italy were Greeks; and even Etruscan civilisation came from Asia Minor at an early period. The Roman Empire of pure Roman and Latin races was political and military, not scientific. Thus the earlier Roman introductions in Europe were actually Greek.

Another source of European civilisation was through the Danes at the migration of Sigge Fridulfen, last of the Odins, from Asgard (near the Volga) to Denmark, c. 70 to 50 B.C. His introductions were partly Persian and Asiatic, but partly of Danish development and origin. The connecting link of commerce with Asia through Permian caravans was kept up long afterwards; and a connection with the Byzantines maintained the flow of introductions to a very late period.

The third of the European developments of civilisation and

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progress was Anglo-Saxon of the seventh to the ninth century, and afterwards. Probably it was a combination of Roman, Danish, and Byzantine introductions, with some little development that was original. Its chief seat was Northumbria. The result was that Anglo-Saxon civilisation in the tenth century was far in advance of anything in the old Carolingian provinces. Its decline was due to the Danish ravages of Northumbria, though some of that civilisation had already spread to Wessex, Essex, Kent, and Anglia. In fact, the only civilisations in Europe in the tenth century, apart from that of the Arabs, were Danish, Anglo-Saxon, and Byzantine; for the relics of Roman civilisation had almost vanished. The Danes, hampered by national poverty and domestic want, had become a warlike and naval nation, neglecting their former gentler arts and civilisation. The Byzantines were an effete race, liable to inroads and perpetual attacks that destroyed their civilisation and prevented all development; they transmitted rather than made the relics of development known to them: their power after 821 A.D. was small. But the Anglo-Saxons, after losing Northumbria in 867, East Anglia in 870, and part of Mercia in 874 to 878, retained Southern England till the Danish conquest of 1013, thus preserving their civilisation intact to a comparatively late date. Hence its general superiority to all other European Christian nations in the tenth and eleventh centuries.

In the twelfth century the conditions were changed. The First Crusade of 1097 to 1099 had altered matters. Direct intercourse with the Moslem, and translations of Arabic books, introduced the germs of a new civilisation. European science was now newly based chiefly on Moslem works and deeds, and in some degree on ancient Greek works, also on the spread of knowledge through the Byzantines to a small extent: the rest was a very slow and purely European development of great extension, with some new and original branches of science, before unknown.

Moslem science, that of the conquering Arabs, of the eighth to the eleventh century, had been partly Indian and partly Greek by origin, based on translations from Sanskrit and Greek books, and on personal communication with Indians. Moslem developments were made at Damascus, Baghdad, in Egypt, Sicily, and Moslem Spain.

Treating collectively the scientific and the useful arts,—Europe invented and developed relatively little from the tenth to the fourteenth centuries; but merely borrowed and utilised

Concluding Remarks on General Development

knowledge and methods before known to the Moslems, Greeks, and Byzantines.

Evidently European progress was greatly dependent on Arab scientific translations; yet monarchs and rulers did not encourage translators, though Aelfred the Great, and Edward the Unpatriotic, had given lands and counties for mere sermons. The result of want of encouragement is shown in the lists of Christian scientists (pp. 49, 79, 107). The progress was very slow, being due to gratuitous labor of those who could afford the time, at the risk of personal persecution and destitution. The grand principle of voluntary initiation, toil, suffering, and risk, was established in Europe; but the Moslem scientists had always been rewarded by Asiatic monarchs. Discouragement and morose abstention delayed progress for centuries. The leading political nation of Europe in the twelfth century was chiefly to blame—England—and her position as leader in development was lost through it. Apart from the neglect by monarchs with niggard parliaments, there were two causes that diverted attention from the subject, one the craze for Latinity, the other that for study of law.

Both these things were made very remunerative. The posts of bishops, abbots, and large beneficed clergy were given to men, not for presumed fitness, suitable qualities, or even for presumed piety or its imitation, but for good knowledge of Latin. Law students having good memories could at Bologna, c. 1120, under Guarnerio, plume themselves on the newly-invented degree of Doctor, and obtain a livelihood on the strength of this, combined with the intricacies of badly arranged law. In England, attorneys also rose very similarly in the twelfth century. Afterwards Bachelors and Doctors of Arts, destitute of every art and branch of science, were thus labelled on the strength of a mere knowledge of Latin; little did they think that some day women and mere girls would use their powers of memory to obtain similar degrees, and thus turn the affair to ridicule. The tendency of the period towards Latin and law was a vice turning men of action into literary bookworms; encouragement was wasted on fruitless trees; science could not rise. There was, however, an alternative; if every European nation had sent yearly a dozen students to Toledo, Cordova, Cairo, and other Moslem seats of scientific knowledge, a better end would have been achieved. Instead of that, schools, colleges, and groups of colleges, were largely founded for teaching Latin and educating

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priests for their sacred calling ; and for putting all education in priestly hands. The lawyer and the priest monopolised expenditure, and blocked science and secular training. This was the great error of Europe in the twelfth century.

Moslem scientists had seldom been priests or devotees. The Indian learned men were seldom from among Brahmans that held priestly office. Even abstract philosophy rarely accompanied experimental or theoretic science ; and legal knowledge less often. Apart from those purely devoted to science, the suitable classes would have been the astrologer and astronomer, the magician and conjuror, the bone-setter and herbalist, the builder and architect, the sailor and the military man, the gardener, and the miller, miner and metal-worker. One of each might have combined in a professorial scientific college in every large town, and have formed local scientific developments at various centres within a century. In fact, the ancient Hindus and the later Moslems did something of this sort, the latter requiring a correct knowledge of their own tongue, Arabic. Europe was prosperous enough to start numerous colleges for teaching Latin, and hence was capable of doing this instead. Now, turning to possible reasons against such a mode. Apart from the desire of the hierarchy to monopolise instruction or schooling of every sort, there was a certain strange or false economy in allowing it. The priests already knew their Latin mass, and could read Latin, the language of books of the period ; they already had stipends, and hence could afford to instruct at a low charge in the subjects they knew. The priests also had the reputation of being learned men, merely from knowing Latin ; a mistaken notion, now laughable but then serious. Really scientific professors would have to depend on their salaries or fees ; and a knowledge of Arabic was not to be had at the same cost as that of mere Latin. Abstention is always cheaper than action, but the economy is generally false, and often very mean ; while the result is disaster or harm. In this case it was a delay of two or more centuries ; during which much of the small amount achieved in European science was done by unsuitable persons under great difficulty at serious risk, and mostly in seclusion. The Arabs, on the contrary, had developed all in three centuries, from the end of the seventh till nearly the end of the eleventh century, even during the period of their attacks on all nations. The comparison is just, though painful to us, but the indication of the causes may be useful.

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Let us now notice another hindrance to scientific development in Europe—the craze after abstract philosophy. Philosophy, like almost everything, was of Indian origin; the ancient Greek philosophers visited India to study it; and the Romans borrowed from the Greeks. Now in the earlier centuries and until the fifteenth, Christian Europe had no philosophy at all from without, beyond the Aristotelian in its transmitted form; for Greek and Sanskrit were unknown. Hence the painful attempts of the earlier philosophy to combine Christian religious notions with older Jewish ideas and with Aristotelian philosophy. Their results satisfied no one. There was a strong ill-defined craving after some abstract theory that would account for everything, seen and unseen, with all their relations to each other, all at once, without any particle of doubt. Such cravings were either met by strange deductions from the erroneous dogmas attached to religious subjects, or by philosophic twaddle and mystification. The system of the universe was deemed dependent on some Chaldæan notions borrowed by Moses, and on the literal words of Joshua; transmutation was believed because transubstantiation was proof of it. As late as the time of Shakespear, we have the wonderful philosophic statement, *That which is, is*. Even later, the theory of economy of the universe is little but an extension of the idea *None can carry more than they can bear*; and that of utilitarianism, a mere enlarged feminine household economy and grasping at the profitable. The men that lose themselves among abstract terms have always been deemed learned, at least by the ignorant. The tendency toward such learning of every sort has been a serious mistake, and a drawback from useful toil; but in the earlier centuries the waste of effort must have been terrible. The theologic philosophers constituted the bulk of the writers!

Now the Arabs and Moslems did very little of such things. They had the Koran, a comparatively modern authority for everything in law, religion and philosophy, and wanted no more. They had mystic poets, men of mystic allegory; and they had philosophy founded on the Koran and the received notions of Islam, that was a mere expansion. But they had no craving or groping for new philosophies, no hoping for a fresh theory. Their tendency was either to science, to poetry, or to religion and the law comprised in it. In comparison with them Christian Europe was thus unfortunate.

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In the thirteenth century, when Christian scientists became rather more numerous after the comparative blankness of the twelfth, England was no longer the leader of Europe in progress, science, and development, but was second to Italy (see List on pp. 79 and 80, and Table I.). Not only so, but Italy kept the lead for three centuries or more.

Let us notice some of the probable causes of this indisputable historic fact. To the Italian Latin was easy, and his dependence on priestly instruction in secular matters was slight; his versatility also helped to achieve a literary independence that the Englishman could not attain. The Italians, like the Spaniards, were near Moslem lands, and had more opportunities of acquiring Moslem science than the English; while the Spaniard, with less ability, chiefly confined his efforts to war. Also the Italian was a neighbour of the Byzantine Greek, and in the thirteenth century adopted some Byzantine knowledge, apart from fresco-painting, gilding, and mosaic. There is also a less substantial mode of accounting for deficiency in the comparison; the Italian spoke, wrote, and recorded doings that the disposition of the Englishman would leave almost unmentioned; but the three former causes are clear and undoubted. They are supported by the fact that in the beginning of the sixteenth century, after the Portuguese, Spanish, and English geographical discoveries, when Venetian commerce failed, and these nations opened greater intercourse with Africa, Asia, South America (Colombia), and North America (Cabotia), Italy began to lose the lead in science; though Italian navigators had piloted the great maritime expeditions. Then England again became the equal of Italy in development and science, or superior to it.

Reverting to the thirteenth century; there was in Italy an encouragement of progress and a patronage of the progressive, that only existed in other nations on a very small scale, if at all. Italy was the wealthiest country in Europe after it had acquired the Levantine, Egyptian, and Asiatic commerce that had been diverted from Constantinople by the Saljuki of Anatolia. The naval power of Venice was established at the battle of Sabora, 1177. Pisa, Genoa, Venice, were trading centres for many trading posts, even in Krim, at the time of the Polos; and from diffused wealth Italy was prosperous from the twelfth to the fifteenth century, that is, for four centuries. Pisa was powerful from 1099 to 1290; Genoa, till 1333; Venice, till 1504. The Republic of Florence was free in

Concluding Remarks on General Development

1198; twenty-four towns of Lombardy were acknowledged independent in 1186; Apulia and Sicily were annexed to the Holy Roman Empire of Germany in 1194. Thus the latter part of the twelfth century was a very marked period.

In the thirteenth century patronage and progress sprang up in Italy when it had become wealthy: if such patronage was unknown before that time, and unheard of in other countries during that period, the causes of this are evident. Next, as to the personal disposition of Italian nobles and rich men. If the vices now imputed to them, inhospitality and niggardliness at home, apply to modern epochs of comparative national poverty, they probably did not exist in prosperous times, and may have developed in the natural course of reaction after too much generosity. But apart from domestic affairs, there is ample record that Italy had formerly many munificent patrons of progress, learning, and fine art, men generous on a large scale.

The rise of such patronage may be traced; first it was nearly confined to patronising artists of the new Byzantine introductions of the thirteenth century, painters and sculptors; workers in mosaic and miniature painters; afterwards it was extended to novel achievements of other sorts, inventions and scientific discoveries; and official posts and professorships were founded or assigned to those patronised. The method was based on personal doings of the individual irrespectively of all other considerations, and was hence successful in bringing forward the best men and utilising their powers. It was thus very different from the English method, which was based on various antecedents of the individual, his parentage, place of schooling, popularity among priests, college, age, instructors, and other matters more or less contributory to his success in deeds; while the result usually afforded but little advancement of a very cautious sort. The Italians patronised both sensibly and generously. If such matters are usually best left to Governments and to wealthy public bodies, in Italy, which was a series of detached states and towns, the political condition rendered that impracticable, and this was a special incentive to private and local patronage. That the Italians were far better patrons than the English is attested by records of the lives of Italian and of English scientists and notables in biographical accounts; also it seems historically proved that if State patronage was impossible in Italy, it did not even exist in England where it was possible, beyond the cases of assignment to priestly benefice.

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In the European developments of the thirteenth century, Christian Spain, immediate neighbour of the scientific Moslem, seems to have taken the third place after both Italy and England, not only in amount, but in order of time. Alfonso el Sabio followed John de Sacro Bosco, the earliest Christian writer on astronomy, geodesy, and the calendar; similarly Raimondo Lullo followed Roger Bacon in chemistry; though in each case the development of the Spaniard was greater. But there was also a small series of minor introductions into Europe from the Moslem through the Spaniard. Besides gunpowder, rock mortars, culverins, there were tapestry, carpets, drums, morris dancing, sugar, perhaps some new dyes with the tapestry, and other things in the fourteenth century; which elsewhere in Europe seems to have almost been a century of retrogression. Even Italy suffered so severely from civil war and plague, as to be unable to make any great step in advance during that century.

As to the causes of the blankness of the fourteenth century, these are explained in the section on the Political Condition of that century, which can be resumed at this point; also the short section on General Development, in which the financial difficulties are mentioned in detail.

The fifteenth century was a period of recovery, as regards general development throughout Europe, except in the parts affected by the Ottoman invasions. So marked is this general recovery that it may sometimes be thought that all European progress began in the fifteenth century from a comparative blank fourteenth century. But it was not so. The fifteenth century was relatively non-progressive, from many causes; even if the fourteenth century be treated as utterly wasted, and mentally struck out, the fifteenth century was not a sufficiently worthy follower of the thirteenth; though the recovery was marked.

It is very difficult also to fix any date or time for this recovery, if the two exceptional countries, England and France, be left unconsidered and apart. The notions that the recovery was due to the dispersion of the Byzantine Greeks in 1453; or the introduction of metallic type generally, 1465 to 1475, are untenable. It was not due to the Flemish and Portuguese settlement of the Azores in 1450; nor can we suppose it due to the occupation of the Canary Islands in 1402-05; when a debased religion of miracles, supposed to have been done by One who often declared he would never do

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a miracle in his generation, was forced in blood on some harmless islanders. The Protestant wars, which formed a fighting bond in Europe, had little direct effect beyond the domain of politics and creeds. But the repressive power of hierarchies as regards science and development lasted after direct priestly domination had ceased; their notions were maintained for centuries.

In fact, the cause of the recovery was not single; but if any one of them should be set apart, it was the cessation in building and endowing and supporting new abbeys and priories, which in England occurred about 1414, also in Bohemia, Germany, and other countries less markedly, but about the same time. Through this, Europe was partly relieved of an incubus, or, in other words, was already amply supplied with such things. Effort and money could be spared for other aims. The recovery was then steady and natural, though slow; and the outburst in development of many sorts followed it in the sixteenth century.

One very evident cause of the decline of England during the period between 1103 and 1495, is indicated by the record at those dates, and between them, regarding taxation. (Refer to the Index about Taxes.) The taxes were generally mere benevolences of frank almoign. Few ever gave much, even when the king went to beg for aid. In answer to the request of King Edward of York for an aid of ten pounds, a lady answered: "*Bless thy sweet face, thou shalt e'en have twenty pound.*" But such generosity was rare. The national purse was beggarly till taxes were forced; the nation was niggard, and hence retrogressive.

For the slowness of the recovery generally the causes are indicated in the text for the century (pp. 125 to 137); but as regards the obstacles to the re-development of science, there was a special one, a literary craze for ancient Greek authors, that absorbed Europe during this century. The aim was a dead language, to be taught by clergy and learnt through dictionary and grammar, and a bygone drama and poetry, beautiful indeed, but representing ancient ideas, and when artificially transplanted, a gross pedantry. Had the consumers of midnight oil studied the mere flame as much as the book, they would have founded modern chemistry, instead of deferring it to the eighteenth century. Alas! it is indeed a sad retrospect of wasted effort and pretentious vanity. Italy, the leading country in Europe, as regards scientific progress from c. 1177

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to 1504, or longer, was bitten by this mania, besides that for Fine Art; and thus its only really great achievement in the century was the development of anatomical knowledge, beyond its Greek and its Fine Art; for in the old science, optics, Alberti was only inventing things known to Roger Bacon about two centuries before; and in other sciences the progress was small. All other countries of Europe, except Spain and Russia, suffered so much from various drawbacks, that their doings were still less.

Now, proceeding to the great outburst of European progress in the sixteenth century, an erroneous impression prevails that it was due to the use of fusile metallic type in printing books. Books in manuscript, or printed from wood-block, or stencilled, would have answered the purpose of conveying information nearly as well, provided that persons required the information. Books did not make scientific men or science, but men of science recorded doings in books. The cart did not drag the horse beyond that due to a preceding impetus. There has been a prevalent modern veneration for printed books, accompanied by a depreciation of the men that wrote them, that is astounding. The paper-maker, the type-dropper, the copyist of original sketches and designs, the binder, and the mere bookseller that has not even speculated to the amount of a penny, are important persons in the eyes of many; but the author and the speculative producer, who are the maker and the appreciator, are persons to be pitied or plundered. Men of science have been classed with mere novelists—publishers that hold out the lamp of science to the world are looked on as horse-dealers. Persons are often found to say, they would believe a thing *if they saw it in print*. It is an article of *faith in things hoped for, an evidence of things unseen*, based on the copyist. A revulsion against this folly will take place; inventions will allow original matter to be reproduced direct without copyist's errors, and books will eventually be valued more because less affected by the manipulation of intermediaries. An increasing regard for scientific men has sprung up only recently, for we now find frequently in journals such paragraphs as the following:—"Mr. John Wright, the inventor of——, and author of——, is now in his sixty-sixth year, and lives at——; he is at present engaged in——." "Mr. Thomas Smith, who published a large number of scientific works, in such branches of science, of great public utility, has been knighted in consideration of his services to

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the nation." Thus things are changing, books will be taken at their proper value, as useful records, and men will be more worthily treated.—There is no reason to believe that the folly before indicated existed in the sixteenth century. When science was young, books about it were few—a library of them might have occupied a shelf or two; nor did it matter much whether they were printed with metallic type, or in clear manuscript. The literary craze for ancient Greek authors did require many books, and in this the use of improved type and better printing came into play. Literature gained, not science.

The actual causes of the scientific progress, in the outburst of the sixteenth century, were very different. They were the requirements of bolder navigation in cosmographic discovery, the consideration of new things introduced from formerly unknown lands, the need of new instruments, machines, and appliances, the later re-introduction of algebra, and the necessity for improving fire-arms and weapons. The men that did anything useful in any of these directions could have their doings recorded; and thus others could learn what was already done, and employ their efforts in things beyond.

Before the sixteenth century Europe knew little about the world. Its modern science sprang up in acquiring communication with the rest of the world, and from the introductions following that intercourse; but it had been based on an older set of sciences, acquired in the preceding six centuries under rather complicated conditions; to unravel and explain these has been the aim of these pages.

From the seventeenth to the nineteenth century European development in progress and science was steady and comparatively independent of help from lands beyond it. Asia, aboriginal Africa, America, and Australia, added nothing to their former civilisations from within, but acquired introductions from Europe. European civilisation had now become the leading civilisation of the world, and had outrun its parent, Asia.

The European development in these three last centuries will be found treated in the text, for it is hardly worth while to recapitulate it here. The leader was first Italy, then England; and latterly there was a tolerably equal division between England, Italy, France, and Germany; with a probable prospective further decline on the part of England.

ALPHABETICAL INDEX TO THE RECORD OF PROGRESS, GIVING REFERENCE TO THE YEAR.

NOTE.—*In some cases the reference is made to the Sections on Special Branches, following the Record in each Century.*

- Abacus 1839.
- Aberration 1727
- Abjuring the realm 1624, 1696.
- Absolution 1124.
- Academies (artistic) 1845, 1391, 1604
- Acclimatising 1637, 1844.
- Acoustics 1252, 1700, 1758, 1759.
- Actinometer 1830.
- Admiralty court 1857.
- Adulteration of food 1827, 1848, 1581, 1872.
- Adulteration of wares 1550, 1581.
- Aërated water 1772.
- Aerolites 1798.
- Agricultural institutes 1814.
- Agricultural machines 1605, 1663, 1756, 1758, 1821, 1822, 1829, 1843, 1849.
- Agronomic chemistry 1750, 1829.
- Agronomy 1533, 1551, 1595, 1620, 1736, 1770, 1817, 1822, 1842, 1843.
- Aids *See* Benevolences.
- Air engine 1682, 1695, 1792.
- Air gun 1656.
- Air pump 1654, 1658, 1850. *See also* Pumps.
- Alcohol 1747, 1780, 1850. *See* Distillation and Potato spirit.
- Algebra 1494, 1505, 1590, 1626, 1629, 1631, 1637, 1666, 1684, 1737, 1750, 1766, 1855. *See* Fluxions.
- Alkalimetry 1797.
- Almajisti, or Almagest 1231, 1252.
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- Alum 1460, 1757. *See* Chemical Section, 15th Century.
- Aluminium 1826, 1828, 1855, 1860.
- Alum-works 1453, 1460, 1554, 1563, 1598, 1609, 1757.
- Ambassadors 1512.
- Ambulance 1792, 1810.
- Amercements 1215.
- Ammonia 1668. *See* Chemical Section.
- Anæsthetics 932, 1266, 1270, 1742. *See* Chemical Section, 13th Century.

Alphabetical Index to the Record of Progress

- Anatomy 1189, 1235, 1297, 1316, 1546, 1548, 1619, 1622, 1634, 1652, 1660, 1668, 1787, 1789, 1818, 1816, 1844. *See also* Surgery.
- Angels and anguria . . 1252.
- Anglican church . . . 909, 1171, 1415, 1534, 1833, 1836, 1861, 1869.
- Anglo-Saxon tongue . . 1857.
- Aniline dyes 1826. *See Chemical Section, 19th Century.*
- Animal magnetism . . 1688, 1665, 1678, 1775, 1776, 1778, 1788, 1789.
- Anticorrosive paint . . 1814.
- Antipyretics 1705. *See Chinchona.*
- Antiquities 1120, 1610, 1656, 1738, 1748, 1755, 1840. *See Archææ Sections.*
- Antiseptic water . . . 1780.
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Wood engraving . . .	<i>See</i> Engraving on wood.
Wood pavement . . .	1839. <i>See</i> Paving.
Wood's halfpence . .	1724
Woollen cloth	960, 967, 968, 1050, 1111, 1161, 1189, 1197, 1330, 1340, 1353, 1390, 1420, 1423, 1433, 1550, 1646, 1686. <i>See also</i> Stuffs.
Wort-cunning	<i>See</i> Botany, Herbarium; also in <i>General Development</i> , 11th Century.
Worsted	1327.
Yellow dyes	<i>See</i> Aichil, Saffron, Dyes, and Aniline dyes.
Zinc.	1530, 1553.
Zincography	1817.
Zollverein	1819, 1833.
Zoology	<i>See</i> Beasts, Entomology. <i>See Naturalistic Sections.</i> <i>See General Development.</i>

NOTE.—As these numbers of reference are actual dates, they serve for purposes of immediate comparison, and if retained in memory may be useful at any time.